Nature Magazine

MAY
1956
VOLUME 49 NUMBER 5
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Nature *Magazine*

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IN THIS ISSUE

SUBSCRIPTION RATE

NATURE MAGAZINE is published monthly, October to May, inclusive, bimonthly, June to September, inclusive, by the American Nature Association. Entered as second-class matter May 31, 1927, at the post office at Washington, D.C., U. S. A., and accepted for mailing purposes at the special flat rate of postage provided for in the United States Postal Act of October 3, 1917, and February 28, 1925. U. S. and Canada one year, $4; foreign, $1 extra; two years, $7; life, $100.

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Nature Magazine past and present, is indexed in The Reader's Guide in your public library.

Fossil Birds

There now are more than 400 fossil birds known from North America and the West Indies—less than half of which are represented by extant species. They range from the grotesque, toothed, flying creatures of the days of the giant dinosaurs to the more recent fossils, which cannot be distinguished from some of the common song birds of today.

A checklist of all birds of this area of which fossil traces have been found has been compiled by Dr. Alexander Wetmore, Smithsonian Institution research associate and former Secretary of the Smithsonian. This has just been published by the Institution.

For the most part bird fossils are quite fragmentary. Birds, with their light bones and aerial way of life, are much less likely to be preserved in fossil form than heavier-boned, earth-bound reptiles and mammals. Almost 100 species, however, have been added to the previously known list in the past 15 years. Several of these, Dr. Wetmore points out, are known only from extremely fragmentary remains found in prehistoric Indian kitchen middens. Since they were present during the time of man they cannot be very old, as bird species go, but they have no living representatives.

Fifty Million

Visitor count for all areas under the administration of the National Park Service was 50,007,838 in 1955. This was an increase of more than two million above the 1954 figure. The Blue Ridge Parkway in Virginia and North Carolina, with 4,502,215 visitors, led the list. The most-visited National Park was Great Smoky Mountains in North Carolina and Tennessee, with 2,581,477 recorded visits. Rocky Mountain National Park in Colorado had 1,454,019 visitors to lead the list of western parks.

Licenses

During the fiscal year ending June 30, 1955, hunting and fishing licenses in the United States continued to increase over the previous year. There were 18,854,809 fishing licenses and 14,191,552 hunting licenses purchased. Michigan, with 1,186,454 hunting licenses, and Minnesota, with 1,374,942 fishing licenses, led the lists. Income from license fees were $39,501,838 for fishing and $38,927,735 for hunting.

Bulletins

"Selected References on Conservation Education for Teachers and Pupils" is available from Wilson F. Clark, Secretary-Treasurer, Conservation Education Association, Eastern Montana College of Education, Billings, Montana, for 15 cents.

"Greenhouse Potted Plants" by D. C. Kiplinger is a 160-page, paperbound book available from the Ohio Agricultural Experiment Station, Wooster, Ohio, for one dollar.

"Prehistoric People of the Northern Southwest" by Joe Ben Wheat is a 42-page, illustrated booklet, available from the Grand Canyon Natural History Association, P.O. Box 219, Grand Canyon, Arizona, for fifty cents, plus eight cents for postage and handling.

"Our Natural Resources—and Their Conservation" by Richard L. Neuberger is available from Public Affairs Pamphlets, 22 East 38th Street, New York 16, N.Y., for twenty-five cents, and for lesser prices for quantity orders.

"Growing Loblolly Pine in the South Atlantic States" by Thomas Lotti is Farmers' Bulletin No. 2097, for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., for fifteen cents.

Nature IN PRINT

By HOWARD ZAHNISER

On Bees and Wasps

SOCRATES ON THE DAY OF HIS DEATH, conversing with fellow philosophers on the destiny of souls after death, speculating about the souls that wander until "they are imprisoned finally in another body," concluded that "they may be supposed to find their prisons in the same natures which they have had in their former lives."

"Some are happier than others," he said, "and the happiest both in themselves and in the place to which they go are those who have practised the civil and social virtues which are called temperance and justice."

When asked, "Why are they the happiest?" Socrates answered:

"Because they may be expected to pass into some gentle and social kind which is like their own, such as bees or wasps or ants, or back again into the form of man, and just and moderate men may be supposed to spring from them."

Gilbert Nixon's little volume on *The World of Bees*, which I have been reading, and John Crompton's book of description and celebration, entitled *The Hunting Wasp*, have recalled to mind the comments of Socrates. I regret that the providence of coincidence that brought thus together books of bees and wasps did not also bring a volume on ants to my review shelf, but when I began to browse on other shelves for such a book, and, instead, became engrossed again in Edwin Way Teale's *The Golden Throng: A Book About Bees*, I concluded that I had better not let myself be led further away from the newly published books at hand. Thus no book of ants lies before me now, with these on bees and wasps, and my remembrance of Socrates suggested by these new books is matter only of wasp and bee—and man, of course.

Plato en route

It is Plato's dialog *Phaedo* that brings us Socrates' reflections—his anticipations of death as he lingered with his friends at the threshold that his own soul would soon cross. One sunny day in March this year I read and heard read this dialog while driving—my wife and I—northward from the North American Wildlife Conference at New Orleans across Mississippi and Alabama with that gentleman conservationist of the canoe country, Sigurd Olson, and his lady, Elizabeth. It was Sig who had the Plato along—a paperbound volume—which we read aloud in turn, the reading thus a chance grace that came when he and his lady accepted our invitation to motor with us as far as Knoxville. What chance it was that made the reading *Phaedo* I do not know, but a message that awaited us at Knoxville, and the death the next day it forebode, made the reading seem timely in recollection, and it all comes back now as this reading about bees and wasps recalls Socrates' thought of them as happy embodiments for the departed souls of mankind practised in the civil and social virtues of temperance and justice.

A charming volume

Gilbert Nixon's *The World of Bees* is one of those charming, informative small volumes that come from the devoted intelligence and enthusiasm of a man, with a longtime deep personal interest, who at last is moved to communicate what he has learned and, so moved, is convinced that he "ought to write a book." That, at least, is my impression as I have read and browsed back over this book. His publishers describe Mr. Nixon as an entomologist of repute, specializing in *Hymenoptera*, the order to which bees belong, and also a lecturer on ants, bees, and wasps, and a practical beekeeper besides. He recalls, at the outset, boyhood bee adventures that extend back beyond his memory, and, after twenty-two chapters of encyclopedic (interestingly written) information, he concludes a final chapter on "How to Study Bees" with this comment:

"The brilliant observations of Henri Fabre and Charles Ferton show how much can be revealed if once insects work their spells on you so that you fall in love with them and are driven to probe their secrets. Such men are of exceptional calibre and most of us cannot hope to emulate them. But even if we lack the perseverance and patient skill that bring fresh discoveries, we can still get a lot of fun studying bees in our own private way. Their habits are rich and varied enough in themselves to provide constant entertainment for a lively curiosity. And if these insects, whose ways, I hope, are no longer a mystery to you (at the end of this book), do no more than take us into the sunshine, then we can be grateful to them. For in their company we shall most certainly forget our cares and find pleasant recreation."

John Crompton's volume on *The Hunting Wasp* tempts us not so much to the wasps themselves nor affects us so infectiously with enthusiasm and information. Rather it intrigues our interest as its writer skillfully discusses a subject that he has recognized as appealing to readers. The result is excellent reading for intellectual entertainment. The play of the author's humor and his alertness in anecdote and analogy add amusement to the volume's offerings. Perhaps one can fittingly characterize Mr. Crompton's achievement by saying that rather than communicating personal experience and information he entertainingly *interprets* his subject by leading his reader through other interests. Thus, he introduces the beetle-hunting family of wasps called Cerceris by arousing interest in man's competition from insects and in governmental bounty programs. Cerceris "has joined us in the campaign against beetles." Mr. Crompton then describes the struggle of wasp and beetle and, after interesting side comments on some of Fabre's experimenting, returns as follows to Cerceris, telling of how she carries "her prize home:"

Wasps in the air

"It is twice her weight, but it is surprising how easily a heavy weight can be carried by air—once the carrier is airborne. She turns over the inert form she has so maltreated on its back and again grasps its mutilated snout in her jaws. Then, clasping the body between her legs, face to face, breast to breast, she struggles to rise, and having risen flies off with him. She alights at the open door of her house, drags him in, opens one of her rooms, and hauls him inside."

After describing the wasp's egg-laying on the beetle "on the exact spot where the stiletto was inserted" when it was stung by the wasp and thus paralyzed, Mr. Crompton relates an amusing (as he tells it) incident of his boyhood, as follows:

"Mothers are like that. They look at things from only one angle. The memory of my boyhood is getting a little dim now, but one event stands out and, I think, accounts for a right ear that has caused trouble ever since the episode in question. I was about thirteen and the scene of the tragedy was a road covered with snow that had melted and then frozen. A child of some four years flashed across my sober elder path shrieking joyously in the way these juniors do. His impetuous course on the glassy terrain met its inevitable end and he crashed heavily. I, as a perfect gentleboy, picked him up yelling and shrieking to high heaven, and put him on his feet. Unperceived by me, the call of her young had drawn from one of the massed houses on one side the mother, a stout creature and powerful. She, with the absence of sober reflection so often apparent in the female, jumped to the conclusion that I, the rescuer, had assailed her offspring and was still in the process of maltreating him. The result was a blow on the right ear that laid me quite as flat as the child I had just righted up. When semi-consciousness returned and I had got up and was beginning to tell her the facts I found she had gone, cum child, and was shutting the door. The echoing crash of that shutting door and the sense of the gross injustice of the whole thing has not faded with the years. One day I feel I will go to that town and that house and explain things to that woman and demand an apology. Or might the other ear get damaged too? One never knows with mothers."

Kinds of wasps

Thus Mr. Crompton's entertaining account continues with various chapters on the various kinds of wasps—caterpillar hunters, beetle hunters, bee hunters, grasshopper hunters, subterranean hunters, fly hunters, spider hunters, ant hunters, cement makers, social wasps, and hornets. Mr. Crompton has written earlier books on *The Life of the Spider* and *Ways of the Ant*, which I should like to have read with this volume on the wasps, and we can look forward to other volumes also, I trust.

Mr. Crompton himself as a beekeeper has formed what he calls a bias against the social wasps, but to me, at least, his chapter on them is the most interesting of all. Perhaps this is because Mr. Crompton's own observations are of apparently greater importance in this chapter. Perhaps it is because the social wasps, by being social, seem more like the bees in being possible hosts as Socrates surmised for departed souls of men and women with civil and social virtues. Meditation on this prospect in the light of Gilbert Nixon's information and John Crompton's interpretive accounts is something that intrigues us further, but comment on it will have to be postponed.

The Hunting Wasp. By John Crompton, Boston: Houghton Mifflin Company. 1955. xiii + 240 pp (4½ by 7¼ in.) with bibliography and index. $3.

The World of Bees. By Gilbert Nixon. New York: Philosophical Library. 1955. 214 pp. (3½ by 6¼ in.) with 27 drawings on 16 plates and frontispiece drawing, in color, by Arthur Smith, and index. $4.75.

How to Make A Miniature Zoo

By Vinson Brown. Boston. 1956. Little, Brown and Co. 212 pages. Illustrated by Don Greame Kelley. $2.75.

Collecting and caring for the smaller mammals, insects, spiders, amphibians and reptiles, and keepable birds should not be undertaken by the individual, the school, or by group leaders without the aid and advice of this excellent and practical little book. The author provides a great deal of how-to-do information.

Psychology of Animals in Zoos and Circuses

By H. Hediger. New York. 1956. Criterion Books, Inc. 166 pages. Illustrated. $6.50.

During his lifetime the author, now Director of the Zoological Gardens in Zurich, Switzerland, has been devoted to the study and care of animals. His research has been carried on in the field as well as with respect to animals under captive conditions. This book, originally published in German, is the result of this work and contains much fascinating reading, and presents many surprising items of information.

Songbirds of America

By Arthur A. Allen and Peter P. Kellogg. Foreword by Roger Tory Peterson. New York. 1956. Book-Records, Inc. $4.95.

This is a "Soundbook," a combination of text and sound. General introductory text deals with birds, their ways and value. Then 24 birds are described and illustrated in color. Sections discuss bird song recording, bird photography and attracting birds. All this is capped by the inclusion of a recording of the songs of the two dozen birds described and pictured. The recordings are 33-1/3 or 45 rpm. as desired. Through this combination birds come to life in what is a truly unique manner and in this first "Soundbook." The birds included are bluebird, brown thrasher, chickadee, Carolina wren, red-eyed vireo, warbling vireo, yellow warbler, robin, goldfinch, catbird, red-winged blackbird, rose-breasted grosbeak, bobolink, mocking bird, meadowlark, indigo bunting, Baltimore oriole, wood thrush, house wren, song sparrow, fox sparrow, white-throated sparrow, pewee, and cardinal.

Getting Acquainted with Nature

By Andrew A. Wilson. New York. 1956. Exposition Press. 158 pages. Illustrated. $3.00.

Although the basic audience sought for this book is the grade-school teacher and her pupils, it should appeal to the individual with a beginner's interest in Nature. The author is Director of Elementary Education in West St. Paul, Minnesota, and an ardent Nature enthusiast and conservationist. Throughout his popular and readable text is woven the conservation thought, and in introducing his readers to many of the more common things of the natural world he succeeds in stimulating a real appreciation of them. He dedicates his book to "the Junior Audubons in America and their teachers." These have inspired him to write this introductory book.

Rocks and Minerals

By Richard M. Pearl. New York. 1956. Barnes and Noble, Inc. 275 pages. Illustrated, including 36 color illustrations. Paper-bound. $1.95.

This book is directed to the general reader and seeks to present in popular language up-to-date and accurate information on the entire range of the mineral kingdom. Explanation of the classification of rocks and minerals is provided, and a guide to their recognition and identification. Emphasis is placed on radioactive minerals, fluorescent minerals and meteorites, and data is provided on prospecting for uranium and other minerals, and on mining them. The author is Associate Professor of Geology at Colorado College.

My Hobby Is Photography

By Don Langer. New York. 1956. Hart Publishing Co. 128 pages. Illustrated. $2.95.

This is another in the "Hobby" series by this publisher, the author being Camera Editor of *The New York Herald Tribune*. It is a simple, direct and practical introduction to the hobby of photography. It covers the different kinds of cameras, their use, filters and lenses, flash and color pictures, camera tricks, darkrooms, developing and printing, selling pictures and just about everything the beginning and amateur photographer would like to know. It is a most comprehensive and concise book.

Briefly Noted

Pet Dalmatian by Evelyn S. Nelson; Pet German Shorthaired Pointer by Richard S. Johns; Pet Pug Dog by Filomena Doherty; Pet Miniature Schnauzer by Marie Slattery. Fond du Lac, Wisconsin. 1956. All-Pets Books, Inc. Each 64 pages, paper-bound. $1.00 each. Four titles in a new series on the care and breeding of these four breeds of dogs.

A Short Dictionary of Weaving. By M. E. Pritchard. New York. 1956. Philosophical Library. 196 pages. Illustrated. $6.00. Compilation of spinning, dyeing and textile terms and a beginner's guide to weaving and dyeing.

Tony of the Ghost Towns. By Marie Halun Bloch. New York. 1956. Coward-McCann. 156 pages. Illustrated by Dorothy Marino. $2.75. Story for youngsters about a boy living near several ghost towns in Colorado's Rockies.

Geometry of Four Dimensions. By Henry Parker Manning. New York. 1956. Dover Publications. 348 pages. Paper-bound. $1.95. Introduction to this modern branch of mathematics.

Susie Starfish and Peter Porpoise. By Mildred T. Woodall. New York. 1956. Greenwich Book Publishers. Illustrated by Helen Ludwig. $2.00. Two stories for the quite young youngsters by a school teacher.

The Java Wreckmen. By Frank Crisp. New York. 1956. Coward-McCann. 248 pages. Illustrated by R. M. Powers. $3.00. An adventure story for boys about what is found forty fathoms down in the seas.

Dictionary of Magic. By Harry E. Wedeck. New York. 1956. Philosophical Library. 105 pages. $3.00. Dictionary covering rites, evocation, spells, alchemy, conjuration, possession and exorcism.

History of the Croatian People. By Francis R. Prevenden. New York. 1956. Philosophical Library. 134 pages. 64 pages of plates. $7.50. History of these people from the time of their arrival on the shores of the Adriatic until 1397, A.D.

Dictionary of Arts and Crafts. Edited by John L. Stoutenburgh, Jr. New York. 1956. Philosophical Library. 259 pages. $6.00. Terms and techniques in this broad field.

Cats. By J. H. De Beer. Boston. 1956. Charles T. Brandford Co. 88 pages. Illustrated. $2.00. Practical handbook on the history, housing and care, training, ailments and breeding of cats.

See through the Forest. By Millicent Selsam. New York. 1956. Harper and Brothers. Illustrated by Winifred Lubell. $2.50. Introduction to the various levels of dwelling within the forest. For the younger reader.

The First Book of Gardening. By Virginia Kirkus. New York. 1956. Franklin Watts, Inc. 69 pages. Illustrated by Helene Carter. $1.95. Latest in this series and an introduction to gardening for the youngster with a green thumb.

Lucky Days. By Laura Pardee and Elizabeth Young. New York. 1956. E. P. Dutton. 127 pages. Illustrated by Dorothy Bayley Morse. $2.50. Story for youngsters, especially those who enjoy the outdoors.

Cats' Tales and Dogs' Days. By George deClyver Curtis. New York. 1956. The American Press. 165 pages. Illustrated. $3.00. Stories about cats and dogs who shared the California mountain home of the author.

Second Satellite. By Robert S. Richardson. New York. 1956. Whittlesey House. 191 pages. Illustrated by Mel Hunter. $2.75. Timely science fiction by a California astronomer.

Contents noted BY THE EDITOR

WILD TURKEY, PRONGHORN ANTELOPE AND KING SALMON will soon appear on three-cent stamps of the United States. First to be released will be the turkey stamp, on May 5, 1956, at Fond du Lac, Wisconsin, and it is the work of Bob Hines, artist for the U.S. Fish and Wildlife Service. In our issue for June-July, 1950, we carried an article by E. R. Kalmbach of Boulder, Colorado, urging issue of such stamps and illustrated by several excellent suggested designs for wildlife stamps. In connection with the article we said: "Perhaps one day the birds and mammals of the United States will be accorded official postoffice recognition equal to that in many other countries." We are happy that a start is now being made in this direction. It would be appropriate if people interested in wildlife and conservation would make a special effort to request and use these stamps on their mail. It will cost them no more than the usual postage and should encourage this policy and, perhaps, pave the way to the issuance of many more wildlife stamps.

THE BERNARD DEVOTO NATIONAL FOREST would be so named under a bill filed jointly by Senators Morse and Neuberger of Oregon. The Clearwater National Forest in Idaho is proposed for this distinction. In introducing the bill, Senator Neuberger paid tribute to the conservation contribution of the late Mr. DeVoto, saying: "He fought with tongue and pen to safeguard our natural resources of timber, wildlife, soil, meadows, fisheries and scenic grandeur." The Senator points to precedent, citing the fact that he was present when the Columbia National Forest in Washington State was formally renamed the Gifford Pinchot National Forest. He adds that Mr. DeVoto was born at Ogden, Utah, and made the study of Lewis and Clark a lifetime project. The bill for the change in name has been designated S.3210, and its enactment would result in proper tribute to one deserving of this recognition.

WHEN KEEP AMERICA BEAUTIFUL, INC. was first launched, thanks to the foresight and support of industry, the litter problem it was dedicated to abate was seen largely in terms of communities and roadsides. Certainly our outdoor manners are bad enough in these areas, and a job of education must be done. Soon Keep America Beautiful organized an advisory council of a wide variety of organizations. Among these members are a number of conservation groups, whose interest and experience do not stop with the littered environs of our highways. They know that people can be litterbugs in forests and parks, in wilderness regions and by the fishing stream, in picnic areas and at camp grounds. To such areas people take the potentials of litter and leave those areas with the litter potential sadly realized. Thus the concept of the whole problem of litter and its control has gradually been broadened, and logically and necessarily so. And The Wilderness Society has suggested an appropriate secondary slogan to that inherent in the name Keep America Beautiful. This slogan assumes that containers and the like that are taken *into* the outdoors can equally be taken *out*, and urges: "You CAN take it with you!"

BALKED BY THE UNITED PROTESTS of conservationists, and by the Secretary of the Interior, those seeking to invade and take over 10,700 acres of Wichita National Wildlife Refuge in Oklahoma have not given up. The Army is back at the doors of Congress in defiance of conservation sentiment. Congressman Wickersham, whose Oklahoma district encompasses both Fort Sill and the Refuge, has introduced H.R. 9665 specifically transferring the disputed acreage. Senators Monroney and Kerr of Oklahoma have introduced S.3360 in the Senate, a similar bill. The House bill is in the hands of the House Committee on Merchant Marine and Fisheries, Hon. Herbert C. Bonner of North Carolina chairman. The Senate bill is in the hands of the Senate Committee on Armed Services, Senator Richard B. Russell of Georgia chairman. The Army lobby has already swung into action, and conservationists have an opportunity to register their opinions with either committee, or both.

USE OF NATIONAL WILDLIFE REFUGES for various recreational purposes is looming as more and more important each year. The annual report of the U.S. Fish and Wildlife Service for the fiscal year ending June 30, 1955, reveals that 5,202,260 persons made recreational use of these areas during the year. This development serves to emphasize the importance of surrounding the refuges with better legal protection than is now afforded by law. This is proposed in pending legislation.

THE FEDERAL FOOD AND DRUGS ACT is fifty years old this year, and observance of this golden anniversary is being sponsored by The Association of Food and Drug Officials of the United States. This event is also a moment to pay tribute to the late Dr. Harvey W. Wiley, whose indefatigable fight for these laws made a tremendous contribution not only to the welfare of the American people but to the sound economic progress of the industries involved. R.W.W.

Sea oats, shipwrecks and surf-casting are three of the many attractions of the Cape Hatteras National Seashore Area, now a part of our National Park System and preserving the fascinating and historic North Carolina Outer Banks.

North Carolina's Outer Banks preserved as

America's First National Seashore Park

SEA, SAND, surf and sky, birds, bottle-nosed dolphins, sun-bathing, sailing, swimming, hiking, picnicking, camping, photography, geology, surf fishing, history, shipwrecks, drama—something for everyone is to be found in our first national seashore park. This is the Cape Hatteras National Seashore Recreational Area on the northeastern coast of North Carolina, where lie the history-famed Outer Banks.

Preserving 28,500 acres, the area extends seventy miles southward from Whalebone Junction at the southern boundary of Nags Head, on Bodie Island, and includes Hatteras, largest barrier island, and Ocracoke Island. Each island is separated from its neighbor by an inlet. The Area embraces photogenic Cape Hatteras Lighthouse, tallest lighthouse in the country, and the large and dramatic Pea Island National Wildlife Refuge, where thousands of greater snow geese and other waterfowl winter. There are many unwritten sagas of the unsung heroes of the Coast Guard and the earlier Life-Saving Service, who rescued victims from the seas, some from submarine sinkings during two World Wars, some from the many wrecks off Hatteras and the dread Diamond Shoals.

Within the natural boundaries of the Area are several quaint villages, each with its own individual character. Among these are Rodanthe, where Old Christmas is held on Jan. 5; Waves, Salvo, Avon, and Buxton, where citrus fruit grows. There are Frisco; Hatteras, with its fishing fleet; Ocrakoke, with Blackbeard and pirate lore. Not on Federal land, these villiages will provide oppor-

By CHARLOTTE HILTON GREEN

Photographs courtesy North Carolina Department of Conservation and Development

tunity for development of facilities for visitors. Most of the length of the Area the new Banks Highway is within sight of the open Atlantic, and there are parking turnouts where one can leave the car and walk to the beach. Driving onto the sand is dangerous.

Summer visitors can vicariously relive some of our nation's earliest history at nearby Roanoke Island, where Paul Green's famed symphonic drama, *The Lost Colony*, is produced annually. Antedating the mysteriously "lost" colony was the day in 1584 when doughty British sea captains, Barlowe and Amadas, entered the sounds by one of the inlets, landed on Roanoke Island, and made the first ornithological record of this middle Atlantic seaboard. Climbing one of the tree-covered dunes girdling the east side of the island, they gazed about them. Captain Barlowe wrote: "Under the bank and hill whereon we stood we beheld valleys replenished with goodly cedar trees, and having discharged our harquebus shot, such a flock of cranes [probably egrets and herons] arose under us, with such a cry redoubled by many echoes, as if an army of men had shouted together."

Cape Hatteras Lighthouse is the tallest brick lighthouse in the United States and extremely photogenic. It is still in operation and is a famous landmark in the Seashore Area.

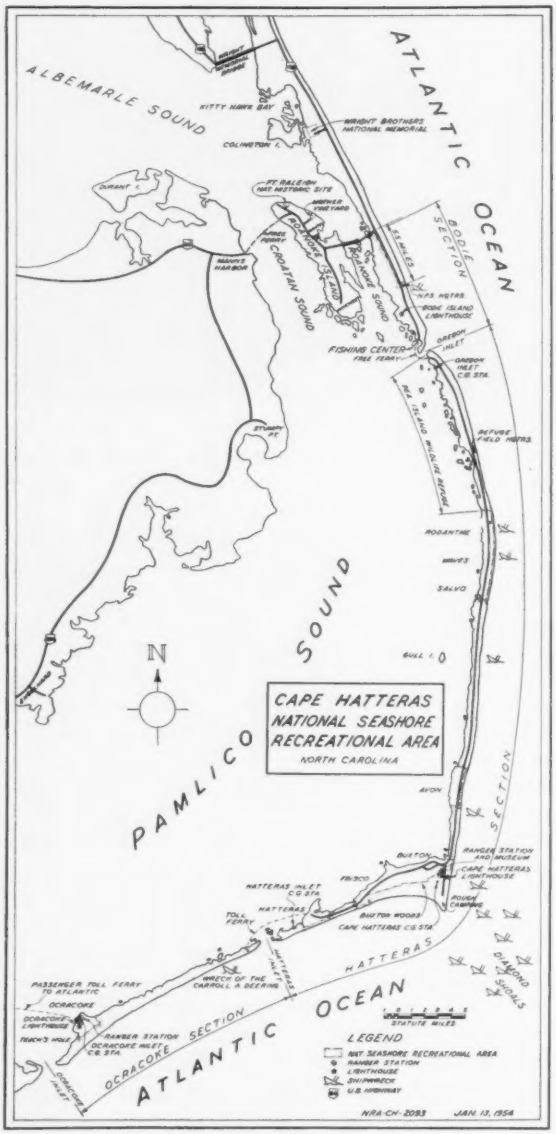
There was another day, when Sir Francis Drake sailed into these same waters. He took back to England with him a discouraged and hungry colony, a short while before a ship from England arrived bringing supplies and reinforcements.

Not far away, but across more than three centuries in time, on the sands of Kill Devil Hill, two brothers changed the history of the world when they made the first successful flight in a powered airplane. Today a fine monument to Wilbur and Orville Wright marks the spot. While not included in the seashore reservation, it is a National Memorial.

Just what are the "Outer Banks," and how was it possible that so much land was available within easy driving distance of the heavy population concentration of the East? Fortunately inaccessibility made this region far away. There were practically no roads, and few people had jeeps, or trucks with 4-wheel drives.

But, first, whence came these barrier islands, or "Outer Banks?" Depending on whose geological lore you are following, long ago the sea level was about twenty-five feet higher than it is at present. Today, riding eastward from Raleigh, the geologist can trace out the "six giant steps to the sea," the so-called six terraces. These represent different coast lines since the time when the sea came to within five miles of where Raleigh now is. Came the last glaciation and, so geologists say, the sea level dropped fifty feet or more, and the shore-line was about twenty-five feet *lower* than it is today. The sounds, Albemarle, Croatan, and Pamlico, all now west of the Outer Banks, were sand flats. Then wind, that mighty landscape engineer, began shifting the sands into dunes and ridges; began the building of the barrier islands. As the great Ice Sheet melted the sea level rose again, reaching today's approximate level and making shallow sounds.

Brother Wind is still at work, building sand dunes and ridges, tearing them down, shifting them around. Sometimes his girl friends give him a helping hand, as "Hazel," "Connie," and "Diane" did recently. For untold thousands of years, the winged gypsies of the



National Park Service map of the Recreational Area. A bridge is being built across Croatan Sound and other developments are in progress, but this map shows the general character and location of the new reservation.

skies—geese, swans, ducks and other waterfowl—found the area a wonderful wintering place. Here is an important way station on the Atlantic flyway where several heavily traveled migratory routes of waterfowl converge. So a 5880-acre tract, located southward from Oregon Inlet, was set aside as the Pea Island National Wildlife Refuge. This area marks the southern terminus of the greater snow goose migration, each winter several thousand wintering here, as do many thousands of Canada geese, brant, and all species of ducks of the North Carolina Coast. There are some whistling swans among some 177 bird species recorded on this Refuge.

Lack of roads did not keep bird enthusiasts away. For years Harry T. Davis, Director of the North Carolina State Museum, has led banding expeditions of Carolina Bird Club members to Pea Island to band laughing gulls, royal terns, black skimmers and several kinds of herons. Some years a thousand or more birds have been banded, and much information about migration and nesting habits is being gained from this cooperative banding endeavor.

In early January, 1954, members of this club came from the two Carolinas for their annual winter field trip, and to participate in the Refuge's Christmas bird count. What a dramatic place that refuge is! At one place we saw several thousand greater snow geese. Something startled them—once it was a bald eagle flying overhead—and they rose, their white bodies glistening in the sun, their black wingtips glowing like polished ebony. Above, the sky was blue, with great white cumulus clouds; below, the shallow, fresh-water ponds reflected the blue, cloud-flecked sky.

At another stop, where we were watching more thousands feeding, an airplane passed overhead and the geese arose almost as one, while ahead, as the plane approached them, we could see other groups rising. It was a cold but sunny day, yet several times we heard the golden-breasted meadowlark sing its lilting *Spring-O'-the-year, Spring-O'-the-year,* even while we were watching the awe-inspiring sight of those thousands upon thousands of snow geese which, within a few months, would be rearing their young at the very top of the world. So does the wonder and mystery of migration bring the far-flung places of the world to our consciousness. I thought then, as I have thought many times, "I would not trade one such day for all the night clubs in the world."

At Pea Island, and, in fact, on other barrier islands, much work is necessary to stabilize the dunes, work once done by the E.C.W. Dikes were also built to provide fresh-water marshes or ponds, and these impounded areas, with rain as the only source of water, have produced an abundance of food plants like sago pondweed, widgeongrass, bulrush and spikerush. As these ponds remain fresh throughout the year the Refuge has some nesting black ducks and blue-winged teal, and Pea Island also contains the only considerable breeding population of gadwalls on the Atlantic Coast.

Spring, and summer, too, are interesting times to visit both the Refuge proper and the Recreational Area, although, at times, the mosquitoes are bad in summer. Early spring, when the northward shorebird migration is at its height, is a breath-taking time, with some thirty-four species having been reported. These include black-bellied plovers, willets, ruddy turnstones, yellowlegs, sanderlings, least and semipalmated sandpipers, dunlins, thick-billed plovers, black skimmers, an occasional oystercatcher and avocet.

Summer brings many breeding birds, large numbers of laughing gulls; royal and other terns; black skimmers; barn swallows, which nest about the buildings;

Snow geese take wing from Pea Island National Wild-Life Refuge, which is within the National Seashore Recreational Area. This refuge of 5880 acres gives sanctuary to a teeming and varied bird life, making it an attraction for bird enthusiasts the year around. Below is the entrance to the Pea Island Refuge.

catbirds, yellowthroats and other songbirds that nest in and about the low shrubs surrounding these ponds. Redwings and boat-tailed grackles are present throughout the year; herons and egrets are increasing. Loons, grebes, vultures, hawks, bald eagles and mourning doves are also seen at various times.

Of course, summer is the time when most people feel the call of the national parks and recreational areas. Locations at this new Seashore Area are being designated where camping is permitted, one at Oregon Inlet and the other near the point at Cape Hatteras. A maritime museum has been developed by the National Park Service near the old Hatteras Lighthouse to tell the story of the sea and the heroic people who followed it. A museum of a different type is scheduled for lower Bodie Island to display the flora, fauna and natural history of the region. There will be outdoor blinds from which visitors can observe waterfowl.

Some of the finest sport fishing on the Atlantic coast can be had in both the sounds and the ocean surrounding the Seashore Area. Channel bass, bluefish, sea mullet, trout, spot, croaker, and many other species are taken in season. Offshore, Gulf Stream fishing usually starts in May and lasts until cold weather, the lure being dolphin, amberjack, bluefish and mackerel in great numbers, and blue marlin, white marlin, and sailfish.

Due to the nearness of the Gulf Stream, the temperature is rather mild, but somewhat damp, the annual mean being 62 degrees, ranging from a mean of 46 degrees in midwinter to a mean of 78 degrees in mid-summer. Growing seasons average 42 weeks, and in and near the village of Buxton are some citrus fruits, which actually ripen. Buxton woods, at the widest point of the Outer Banks, extend westward for some eight miles, with fine stands of loblolly pine, live oaks, American holly and yaupon on the higher ridges and slopes. In between the ridges are marshy valleys, with some fresh-water ponds and some lush subtropical growth of dense banks of ferns, shrubs and climbing vines. Here are dwarfed white-tailed deer, and a secretive birdman insists he has seen limpkins, but he will not divulge the spot.

At picturesque, storm-swept Ocracoke is a fine, almost landlocked harbor, Silver Lake, the finest on the Outer Banks. There many trawlers, sport-fishing boats and pleasure craft can dock, as well as seek harbor in time of storm.

Wild ponies, supposed to be descendents of those that managed to swim ashore from wrecked ships carrying horses, used to roam many of these Outer Banks. "Round-ups" are still held annually. At Ocracoke some of these ponies, which have been captured and gentled, are often available for riding by visitors to the seashore.

Aerial view of the town of Rodanthe on Hatteras Island. There "Old Christmas" is still celebrated on January 5. This is one of several towns within the Seashore Area but not on Federal land. In these communities facilities for visitors will be developed.

Much history and legend have developed side by side during the centuries between those first settlement attempts on Roanoke Island and today! Many are the weird tales of shipwrecks along these coasts; many are the unsolved mysteries! One often repeated is that of the ghost ship *Carroll A. Deering* on Ocracoke Island. A five-masted schooner, it was found stranded on Diamond Shoals in 1921. No crew was aboard, but food was still in the galley pots! There was not a living thing but the ship's cat. What became of the crew, no one knows to this day. The remains of the wreck drifted ashore and can still be seen on Ocracoke Island. Sands bury it, then a hurricane comes along and exposes it again to the souvenir hunter.

Pirates sailed these waters and legends about them are legion. Edward Teach, better known as "Blackbeard," maintained a rendezvous on Ocracoke, near Springers Point (Inglis Fletcher dramatizes this rendezvous in her *Lusty Wind For Carolina*). And it was in this area that he was finally killed, in personal combat with Lt. Robert Maynard of the Royal Navy, who had sought him out. Maynard cut off the pirate's head, fastened it to the bowsprit of his ship, and sailed back to Bath, N.C., "where there was much rejoicing."

Perhaps there is no better way to end this introduction to our first National Seashore Area than to pay tribute to the gorgeous sunrises and sunsets seen all along the Outer Banks. From many a dune, at the end of day one can see that "God is at the anvil, beating out the sun, hammering out the glory of a day that's done."

WHEN this robin built its nest in a Wisconsin conifer it was just getting an April start on raising a family. Then came a period of cold and snow, with this unseasonable decoration of the nest. The mother stuck to her task and kept the eggs warm. With the return of springlike weather the eggs were none the worse for the experience and the family was successfully reared.

GEORGE MATTIS

Sandhill Cranes

In Retrospect

By H. H. PITTMAN

Photographs by the Author.

A newly hatched little brown sandhill crane with the tiny egg-tooth still showing on the end of its bill. Below, the youngster is growing up.

WHEN I first visited southern Saskatchewan, sandhill cranes were plentiful and my notebooks mention large flocks as of almost daily occurrence. On my second visit, two years later, they were still numerous. Groups of them, feeding on gently sloping hillsides, looked like flocks of dark-colored sheep. Like the geese of southwestern Manitoba years ago, their numbers seemed inexhaustible and it never occurred to anyone that they would disappear so quickly. The cranes frequented the stubble-fields every spring in search of waste grain, and against such yellow backgrounds they could sometimes be seen for a long distance. Generally their movements were quiet, even sedate, but occasionally one would be seen leaping in the air with widely spread wings as though exhilarated by the intoxicating freshness of the early spring winds.

As spring advanced most of the birds moved on, but scattered pairs remained to nest throughout the district. Even after these had eggs in early May small parties kept coming for a week or so, but the late arrivals may have been non-breeding birds. While the feeding flocks were often so conspicuous, the cranes that stayed were just the reverse and many of the early settlers did not even know these large birds nested near them.

Conditions seemed favorable for photographic work, so on my next visit I made arrangements to try and portray the homelife of these birds, little realizing the difficulties ahead of me. The first one was finding a nest, and although we searched every marsh and slough in the district, and even advertised in a local paper, we could not discover one. I was told that there had been a nest in a large slough about ten years earlier but learned that it had been built by whooping cranes.

All the books at my disposal definitely stated that sandhill cranes made their nests in water, building a bulky structure of slough-grass and rushes with a shallow depression at the top. The nests were said to have a diameter of five feet, or even more, and it was for these that we were looking. Finally we found that the birds were nesting

The young sandhill crane of the smaller little brown species in the protection of the grass of the prairie.

The youngster tries to assume the characteristic attitude of its elders, thinning itself in spindly way for protection.

in drier situations, on low-lying but dry land. The last nest I saw was typical and was on a piece of low land covered with a dense growth of coarse slough-grass from the previous year. This dead, brown grass covered an area of several acres and, although originally tall and straight, had been bent down by the winter snow until it was only about two feet high, clothing the ground with a thick, tangled growth through which it was hard to walk. It was just the kind of place little brown cranes would have chosen, and I would have said it belonged to this species, *Grus canadensis*, except for the fact that I had not heard of these cranes breeding so far south on the prairie within recent years. However, it was this species that I photographed.

The circumstances surrounding the discovery of this nest were amusing, and perhaps worth recording. A farmer rode over one evening to ask if I wanted to photograph a crane's nest, offering to take me to see it the following day. During our conversation he mentioned that some of the sticks in the nest were more than an inch thick and that it was in a large willow-bush. We pointed out that such a nest could not have been built by a crane, but he insisted that no other prairie bird could handle such large and heavy material. Although we knew he was mistaken I agreed to go with him the next day, and it was while we were struggling through the tangled grass that I almost stepped upon a sitting crane. The nest he had found belonged to a pair of ferruginous rough-legged hawks!

Newly-hatched cranes are covered with yellow and brown down. The early darker patches are quickly lost and within a few days they are a lovely golden brown. This persists until the pin-feathers begin to show although the back generally darkens. They follow their parents almost at once and keep up a gentle musical conversation all the time. They are extremely difficult to find and they wander so far that any attempt to make a series of pictures is quite impossible. I had hoped to record the growth and development of the chicks but quickly realized that we were lucky to get any pictures at all.

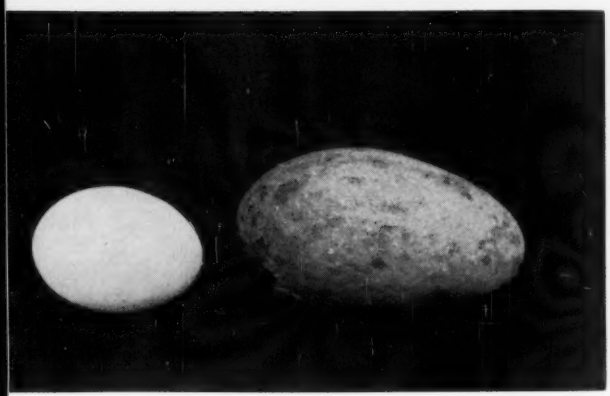
Young sandhill cranes can hide as easily and readily as young marbled godwits, and that is probably the highest tribute we can pay to their skill. The proverbial needle in a haystack has a red flag and a loud speaker attached to it in comparison with a young crane. The few young ones I have seen seemed to have a habit of trailing their wings. They were not hidden in the down as the wings of our game birds or domestic poultry are at the same stage of development. However, birds, even very young ones, do not always act naturally while under observation.

Sandhill cranes have several other calls besides the familiar turkey-like cry used during migration. At times they can be extremely noisy. A flock of about twenty-five once passed me on a mild spring evening, flying slowly, and I watched them alight in, or around, a little water-filled depression half a mile away. At dusk, when we drove by, they were all loudly talking and the confused babel of voices continued for hours. Whether they have ventriloquial powers or not, it would have been difficult to ride straight up to the place in the dark guided by their voices alone.

These large birds no longer breed in southeastern Saskatchewan, and as I left the province for several years after getting the accompanying pictures it is unlikely that I shall ever be able to complete the series. When I returned the cranes had gone and nowadays are only seen passing overhead, often so high up that their calls are unnoticed, and it is improbable that we shall

ever have another opportunity to be as familiar with them again. Some were killed by poisoned grain put out to destroy ground-squirrels, others were shot for the table, but the chief reason for their disappearance was the destruction of their nesting grounds. As cattle and other livestock increased, more pasturage and hay were needed. Marshes and large sloughs were burned to encourage the growth of fresh new grass, or grazed down until there was no shelter left for the birds at a time when they needed it most.

Cranes like the great open spaces that we require for agricultural purposes, and unless they can adapt themselves to conditions in areas we cannot use their numbers will continue to decline. When cultivation was primitive and on a small scale in the West people lived among the birds, but this is not possible today, and we shall never again experience the exciting contacts with wild creatures that made the early days so interesting.



The site of the crane nest in the prairie grass that abounded in an earlier day. At the left the large egg of the crane in contrast to that of the Plymouth Rock hen.

The photographs here were taken about seven or eight miles southwest of the village of Wauchope, in southeastern Saskatchewan. The district consists of gently rolling prairie thickly dotted with depressions or "sloughs" in which snow-water accumulates every spring. Most of them are dry by the middle of summer, but in normal years a few of the deeper ones hold water until fall. Even in these the tall slough-grass often completely conceals the water by midsummer. From the air they look like green oases, for the slough-grass retains its color long after the earlier maturing prairie grasses have commenced to turn brown. At the time cranes were plentiful only a few of the sloughs had trees near them, but today most are surrounded by a healthy growth of willows and poplar. Although widely separated, tree-surrounded sloughs are now so numerous on this part of the prairie that in some places the horizon seems to consist of a ring of trees. There is still plenty of room for the cranes, but southeastern Saskatchewan is too thickly settled now for them to find the privacy and shelter they like and I am afraid they will never return.

Many people find it difficult to realize how abundant wildlife was on the prairie in the early days. We all know of the bison and passenger pigeons, but other wild creatures occurred in spectacular numbers, too. The West was a country of extremes in many ways, and some of the birds, mammals, insects and plants either existed in normal or even negligible numbers, or else were extremely numerous. I have seen white geese rising from burned-over stubble in Manitoba in such numbers that they suggested a snowstorm, and I have seen a Saskatchewan mud-flat literally covered with shore and wading birds. I have also seen prairie lilies in unbelievable numbers, and butterflies, too, occasionally. Of course, observations from a single district can be misleading and rarely afford accurate information about the standing of any particular species, but wild things of many kinds used to be much more plentiful than they are today. Now the only reminder of this past munificence is the occasional gathering of ducks, which now and then assemble on the prairie in flocks of thousands. Cranes never reached such numbers, yet my old notebooks refer to the constant arrival and passing of flocks of hundreds.

CHALLENGE

Show me
an artist's blend
to match the yellow finch
tearing a purple thistle head
to white.

Emeline Ennis Kotula

Even while in the field as General of the Army, Washington asked the planting at Mount Vernon of the

"Clever Kind of Trees"

By E. JOHN LONG

Illustrations courtesy of the Mount Vernon Ladies Association

Some of the "clever kind of trees" that General Washington wanted, including locust, yellow and weeping willows, tulip poplar, holly, crab apple, pawpaw and Virginia pine. The tall tree at the right is a pecan.

GEORGE WASHINGTON's love of Nature and growing things is beautifully exemplified in the grounds and gardens of Mount Vernon, his plantation home in Virginia overlooking the winding Potomac River, and now the goal of many visitors.

Not so well known, however, is the First President's fondness for trees, both large and small. This is remarkable because Washington lived in a day and age when trees were pretty much "a drug on the market." Almost everyone else during colonial times was feverishly clearing the original forests to make more farm land. Not much planting or transplanting of trees was being done.

Except for a few big shade trees or orchards near their houses, most early Americans considered trees as a quick cash crop that might be sold for ship timbers, or as a source of furniture, building materials, or firewood for their own use. Washington did his share of land clearing, and he had his timber lots that supplied most of his own needs for wood, but he also was something of an arboreal experimenter.

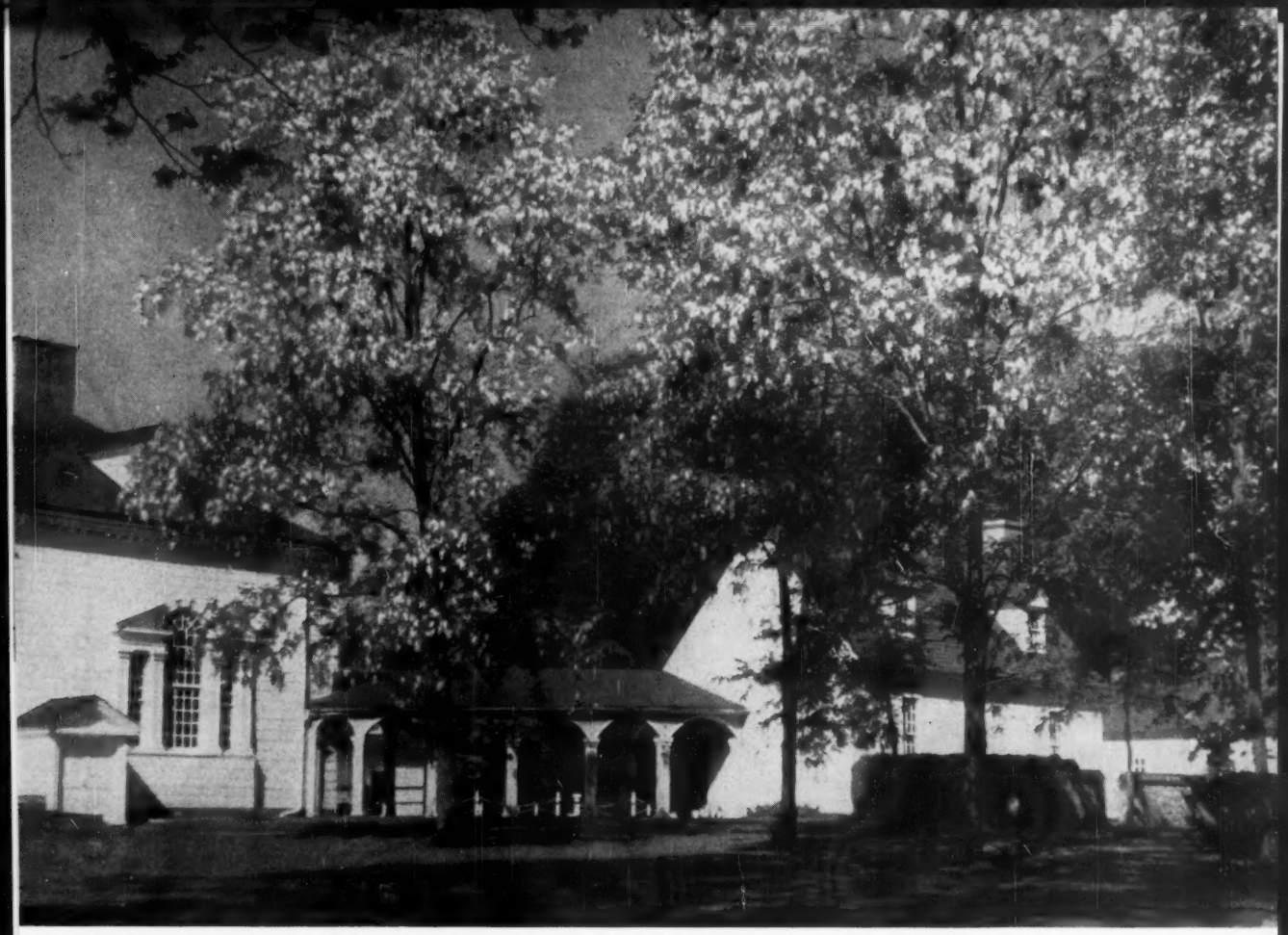
At each end of the Mansion house he ordered small groves to be planted, specifying the kinds of trees and other details, and he asked for reports on their progress even while he was commanding the Revolutionary army.

The first mention of these unusual groves appears in a letter from New York, dated August 19, 1776, in which Washington sends detailed instruction to Lund Washington, his distant kin and manager of Mount Vernon, to set out trees in the lawn areas close to the Mansion, "without any order or regularity, but pretty thick, as they can at any time be thin'd."

The north grove, at the beginning, was to be planted only in black locusts. The south grove, however, was to consist of "all the clever kind of trees (especially flowering ones) that can be got, such as crab apple, poplar, dogwood, sassafras, laurel, willow (especially yellow and weeping willow, twigs of which may be got from Philadelphia) and many others which I do not recollect at present; these to be interspersed here and there with evergreens, such as holly, pine and cedar, also ivy [mountain laurel]; to these may be added the wild flowering shrubs of the larger kind, such as the fringe tree and several other kinds that might be mentioned."

A progress report on the plantings appears in a letter from Lund to George Washington, December 11, 1782. The locusts apparently were thriving, and the north grove plan had been amended to admit flowering shrubs.

Lund wrote: "I planted the flowering shrubs at the



The North Grove locusts in blossom at Mount Vernon. Since this photograph was taken lilacs, pawpaw, Persian jasmine and magnolia have been added to this area.

north end of the house among the locust which were first directed to be put there, but most of them died. I planted them [the shrubs] again, but few of them lived and I will again plant them as you seem to wish them to grow at that end of the house. Yet I think you will never cut away the locust, which now flourish there, to give way for little ill-thriving trees that perhaps may be many years before they look well. . ."

Washington's reply, from Newburgh, N.Y., the same month, told Lund to keep trying, and to plant the other trees and shrubs he had mentioned in the north as well as in the south grove. A postscript reveals Washington's common sense about growing things: "When the case will admit of it, the trees and flowering shrubs that are transplanted. . .have a better chance of living if taken from the open fields than the woods."

That the groves project was one rather close to Washington's heart is further indicated by entries in his diary. On March 29, 1785, he recorded: "Transplanted in the groves at the ends of the house the following young trees, viz. 9 live oak, 11 yew or hemlock, 10 aspen, 4 magnolia, 2 elm, 2 pawpaw, 2 lilacs, 3 fringe, 1 swamp berry, etca."

About a year later, April 6, 1786, there is another reference: "Transplanted 46 of the large magnolia of S. Carolina from the box brought by G. A. Washington last year, viz. 6 at the head of each of the serpentine walks next to the Circle, and 26 in the shrubbery or grove at the south end of the House, and 8 in that at the north end. The ground was so wet, more could not at this time be planted there. . ."

After Washington's death the groves were apparently allowed to run their natural course and die out. Some trees were lost in storms. Drawings and mid-19th Century photographs of the Mansion reveal few small trees or shrubs in these areas. Large trees, which probably did not exist in Washington's time, rose from both ends of the house.

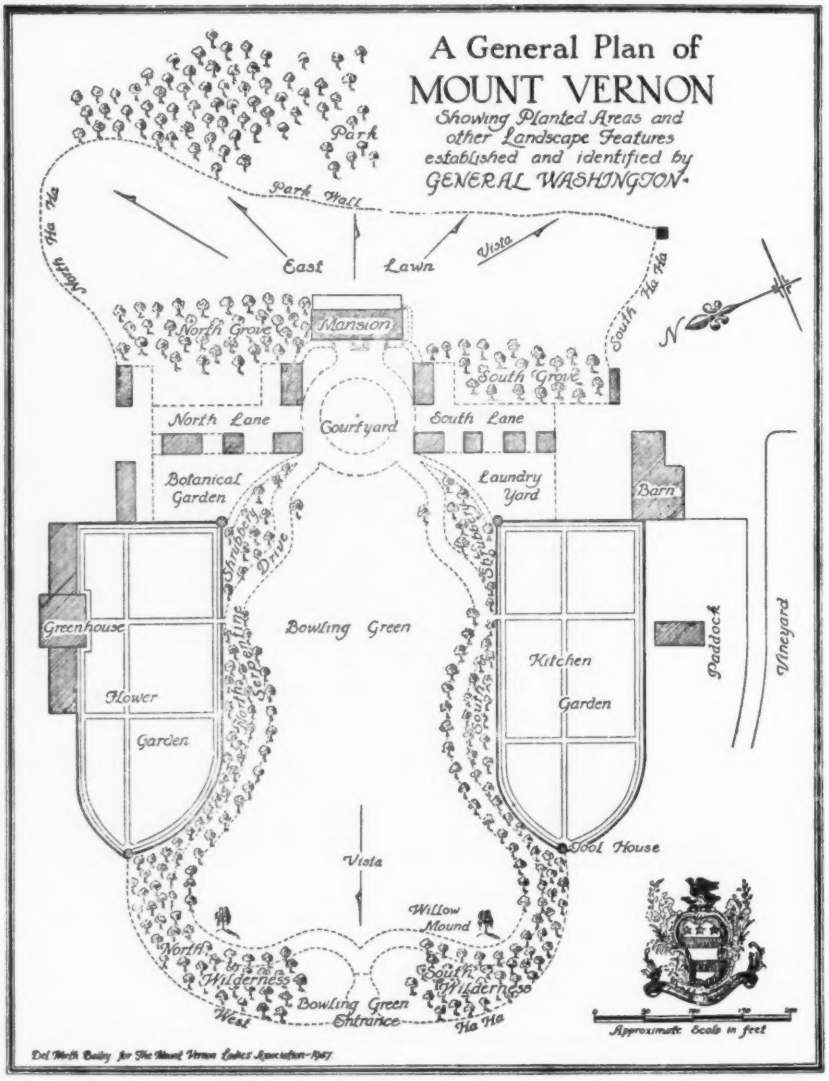
A few years ago the Mount Vernon Ladies Association decided to restore this interesting phase of the landscaping of the Mount Vernon that Washington knew, and to which he gave so much thought and attention even when he was away from the plantation. Many of the trees mentioned by the General were readily available from the wooded areas of the estate, although the transplanting of a couple of good-sized holly trees proved to be quite an engineering job.

Today you will find again a thriving grove of black locust trees, "without any order or regularity," north of the Mansion. In late May, a lovely cloud of fragrant

white blossoms enchants the visitor, as their predecessors must have delighted Washington and his guests. In the north grove also you will find lilac bushes and mock orange, along with pawpaw, magnolia, Persian jasmine and white pine.

But it is the south grove, on a grassy slope that sweeps down from the library windows of the house, which is the most changed, or rather restored. Here, once more, are the "clever kind of trees" Washington specified in his letters and diaries, with "several other kinds that might be mentioned."

Along an ivy-clad brick wall, which partially screens off the South Lane and its utility buildings, runs a row of alternating yellow and weeping willows. The weeping willow, of course, is an alien, and Washington's notation that "twigs of which may be got from Philadelphia" recalls that the graceful tree probably made its American bow there.



Thomas Jefferson's *Garden Book* mentions a Mr. Thomas Willing, of Philadelphia, who "receiving a basket of fruit from the Island of Madiera, having used the fruit, threw the basket into a sink in his yard. After some time it was found that a part of the basket had taken root and was growing, and became the first Weeping Willow tree ever grown in America."

As the accompanying plan of Mount Vernon shows, the south grove is set back to the west a little farther than the north grove. This was done to allow Washington, while seated in his library, an unobstructed view down the Potomac. He liked to watch for ships that might be bringing supplies or visitors to the plantation.

Finest of the south grove trees today, however, are the two magnificent transplanted hollies, gay with berries. Here, too, are several magnolia—*Magnolia grandiflora*, of the big white waxy blossoms. Scattered about you will find other evergreens, mostly pines, and crabapple, lilacs, redbud, pawpaw, fringetree, and swampberry. Also dogwood, aspen, shadbush, tulip poplar, and American elm. And all within a space of less than a third of an acre! They add to the charm of Mount Vernon, and to its history.

Why did Washington refer to this select group he specially wanted at Mount Vernon as "clever kind of trees?"

"No one knows for sure," Mr. R. B. Fisher, horticulturist at Mount Vernon, told me. "The use of the word 'clever' here may be a solecism, although there is an obsolete definition of clever as 'clean-limbed.' We do know that Washington liked to stroll with his guests about the lawn before or after the mid-day meal. A variety of trees and flowering shrubs near the mansion provided an opportunity to point out certain features—budding, flowering or fruit—and this probably induced lively, non-partisan conversation. This is only conjecture, of course, but it is as near to an explanation of the meaning of 'clever kind of trees' as I have found."

And not a bad surmise, it would seem. It leads to the thought that such "clever" groves might find some usefulness elsewhere today.

The female pipefish leaves her eggs in care of

The Paternal Pipefish

By BERNARD L. GORDON

A bony plated fish with a long tubular snout, the male pipefish has a brood pouch where the female deposits her eggs and young ones are hatched.

EXAMINING the catch of a minnow trap, set in about four feet of water in Little Narragansett Bay, Rhode Island, I discovered I had made an unusual catch. It was about eight inches of elongated fish, which was whipping its tail from side to side and swimming rapidly about among the silversides, sticklebacks, and mummichogs that had also been ensnared. At first glance I thought it was a small eel, but when the creature slowed down a little I could see that it was too slender to be an eel. When I gently picked the fish up its elongated snout told me at once that it was a pipefish.

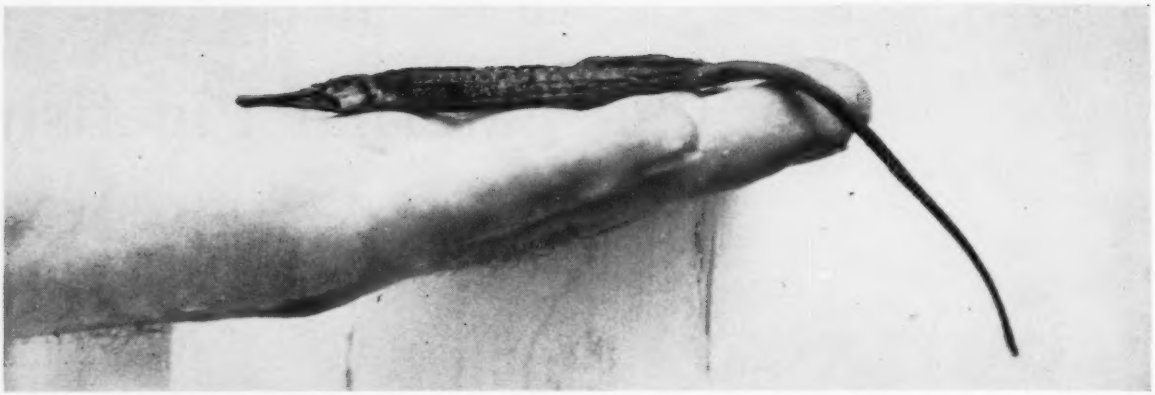
In my palm the fish's eyes, moving in short continuous jerks and, sitting somewhat out from the head, looked straight at me. This was the first pipefish I had ever encountered in my minnow trap, so I put him into a five-gallon glass tank used for marine specimens. The pipefish lived in the tank for almost two weeks and then he succumbed, I fear from malnutrition.

Found along the eastern coast of North America from the southern side of the Gulf of Saint Lawrence and outer Nova Scotia to South Carolina the northern pipefish, *Syngnathus fuscus*, is generally found lurking among seaweeds and eelgrass in salt and brackish water. Pipefishes, when closely examined, cannot be confused with any other species of fish, for their characteristics and peculiarities are piscatorially distinctive. The pipefish is a long, slim, bony creature with a small, toothless mouth at the end of a tubelike snout. It does not appear to have scales but, instead, an armor of segmented bony plates similar to those of the ganoid sturgeon. Its fins are somewhat oddly shaped, with a delicate, rectangular, soft-rayed dorsal fin on the back and a triangular, somewhat fan-shaped caudal fin at the end of its tail. This is important to the fish's manner of locomotion.

The color of pipefishes varies from individual to individual according to their habitats. They range from a muddy green to reddish-brown, corresponding to the hue of the seaweeds among which they may be found. Pipefish differ from most other bony fishes in the structure of their gills, which form tufts of small rounded lobes instead of the usual gill filaments.

Another peculiarity of this fish is its ability to swim in either vertical or horizontal position. When in a vertical position the pipefish performs like its close relative the seahorse by using its dorsal fin, located back of the gills, for equilibrium and to maintain its upright position. When alarmed, or wishing to go from one place to another in great haste, it thrusts into a horizontal position and glides rapidly by making sinuous right and left whiplike movements of its tail, remindful of the propelling motions of snakes and eels.

Still another interesting habit of these fishes is their method of feeding. Their food consists mostly of small crustacea, such as amphipods and copepods, fish eggs and small fish fry. When it feeds a curious snapping noise is made by the pipefish as it moves its head with a bird-like, pecking motion. The pipefish gathers food into its small oral cavity by expelling water from the narrow snout and pharynx with a muscular action of its cheeks, causing a slight vacuum to take place in its mouth. It then thrusts its head at the food particles, sucking them in by suddenly opening its mouth, creating the clicking sound. Although its snout and mouth appear to be rather small, the pipefish can swallow larger prey than one would expect because these parts are flexible and can stretch a great deal. In the act of catching its prey the pipefish is also greatly aided by the mobility of its eyes, which are able to work independ-



Pipefishes have the ability to move each eyeball separately after the fashion of the chameleon, and they find this handy in catching prey. Below is the fan-shaped tail fin of the pipefish. This is sometimes used to stand on and support the weight of the whole body, and, of course, it is an effective propeller.

ently of one another. These eyes are similar to those of a chameleon.

The most unusual characteristic of the pipefish is its method of reproduction. The female of the species shirks her parental duties and deposits the eggs in a sort of marsupial pouch which the male has, again like the seahorse. The father then takes care of all the baby pipefishes' needs until they are able to manage for themselves.

Apparently the earliest mention of the pipefish was in the third century, B.C., by the Greek philosopher Aristotle. Pliny repeats Aristotle's observations in 1, A.D., and then for nearly fifteen hundred years there seems to be no further mention of the pipefish until 1554, when Rondelet published his *De Piscibus Marinis*. In this book he describes the pouch in which the eggs are placed. He said the pipefish casts the eggs into this pouch of the female. Rondelet studied the fishes alive in the water and his observations are quite accurate, except for his mistake on the sex of the pouch-bearing fish. This error in the description of the sex of the pouch-bearing pipefish existed for nearly three hundred years. Then, in 1831, the Swedish naturalist, Eckstroem, wrote that only the male possesses the pouch. This statement caused a forty-year controversy among zoologists, until it was definitely determined that only the male pipefish has a pouch for holding fertilized eggs.

In the summer of 1903 E. W. Gudger made a complete study of the life history of the pipefish at Beaufort, North Carolina. According to Dr. Gudger, a female pipefish that is ready to give up eggs can be recognized by her much-enlarged abdomen due to the presence of ripe eggs in the ovary and oviduct. He states that the act of transferring the eggs from the female to the male is preceded by a curious ritual.

The two fishes swim around with their bodies in nearly vertical positions, the head and shoulder regions bent sharply forward. They then swim slowly past each other, their bodies touching and the male perhaps the more demonstrative of the pair. Just before the actual transfer the male becomes violently excited, shakes his head and anterior body parts in a corkscrew fashion and, with his snout, nuzzles the female on the belly. The female responds to this but does not become so excited as the male pipefish. This act is repeated several times, the fishes becoming more excited each time they touch each other. Presently, quick as a flash, the female pipefish transfers the eggs to the male's pouch and the fishes separate, only to begin again in a few minutes.

In the embrace the fishes intertwine their bodies like two capital letter S's, one interlocked with the other and coming face to face. They thus hold their bodies together while the eggs pass from the oviduct to the pouch. About twelve eggs are transferred at a time, and these are presumably fertilized at the moment of transference from one parent to the other.

The dozen eggs, which are each about one millimeter in diameter, are now in the top portion of the male's brood pouch. Before the male can receive any more eggs he must move the eggs to the lower part of his pouch. In order to accomplish this the male performs some curious movements, according to Dr. Gudger. He stands nearly vertically, and, resting on the back part of his tail, he bends backward (*Continued on page 276*)

"And in a little hollow there may be a snowy cluster of Indian pipe on an August day."

Nature's artistic planning seems everywhere in

The Canadian Carpet

By VIRGINIA S. EIFERT

Photographs by the Author

"THE CANADIAN ZONE. . .is the southern half of the northern coniferous forests, including southern Canada and part of the northern tier of States. . ." So say the textbooks. And over a great part of the Canadian Zone stretches the intricate pattern of the Canadian carpet, one of the most fascinating ground-covers in all of North America.

The Canadian carpet is that growth of low greenery covering the earth of balsam woods and white pine forests, aspen woods and the edges of lakes and bogs. It is so compact and low a cover that a year's growth may not amount to more than half an inch, as contrasted with the fourteen-foot annual expansion of a horseweed in an Illinois bottomland, or the three-foot growth on every branch of a cottonwood tree in Louisiana. Since the North has a short growing season, the annual lengthening of the carpet is slight; and because most of the plants are evergreen, the ground cover often seems to be unchanging from year to year, around the calendar.

The Canadian carpet country may be found from northern Minnesota and Wisconsin across to upper New England and Maine, as well as in southern Canada and occasionally in higher altitudes southward in the Appalachians. You can see it as you drive past the

"Bunchberry sparkles with symmetrical, four-parted white flowers in early summer, replaced with scarlet boutonniers of fruit in late summer."

←

". . .the occasional glisten of a wild orchid—pink moccasins in May. . ."

woods, but the only way to know the individuals that make up this charming carpet of plants is to walk the deer trails or stand ankle deep in wintergreen and ground pine.

Here is a world of cool greenery springing from an usually sandy underpinning, for the Canadian Zone was much influenced by the Glacial Era, which dumped upon it uncounted tons of fine brown sand from which most of the coniferous forests spring today. It is a country that is unlike the shifting uneasiness of dunes, for this glacial sand has been in place for many thousands of years. It has been tied down and fastened securely by the network of ever-present roots, not only of the trees, many of which send their roots laterally in a shallow rooting under the sand, but the roots of the carpet plants themselves. In this they serve their prime purpose—to keep the sand in place. For solid though it may seem, covered lightly with pine needles and the lower layers of porous, disintegrated or partially disintegrated needles in the loose coniferous humus of the northern woods, warm in the sun but winter-cool a few inches down, the northern sand would be as unstable as the dunes along the sea or lake without those roots to hold it.

As it is, there has been a ground cover protecting these glacier-deposited sands of the North almost since the years when the great ice slowly departed. Mosses and lichens may have come first, followed by a creeping tide of green, which moved in from the South as the last glacier retreated. Tundra may have formed before the forests came—forests to stand on ridges left between lakes and growing bogs, and tamaracks and swamp spruces in the wet places. From the edge of open water to the top of the highest pine ridge, small plants grew and often almost covered every inch of open sand. Since most of them were protectively evergreen, with thick, dark green, often waxen leaves, they did not die with the coming of the early frost, and thus did not leave the sand unprotected until growth should come again in spring. If the snows melted, the bare places were not bare, but shining with green. Holding moisture, holding the woods in place, the Canadian carpet has continued from those days until these. The carpet is the distilled essence of the North Country.

Only where man has broken it and prevented the

". . .an amanitopsis mushroom springing from a bank of ripe snowberries."

→

Reindeer lichens form a background for orange chantarelle mushrooms.

carpet from coming back has the sand been permitted by the North to lie bare and loose. Even where logging roads were cut into the great forests, and into the second-growth woods in more recent years, the little plants followed, clothing the raw sand by the following summer with a network of creeping ground pine, wintergreen, and arbutus, accented by the taller stalks of bracken and wild raspberry. Such plants can take a good deal of punishment, and still survive.

Some of them, in fact, have survived through so many vicissitudes, not all of them at the hands of man but principally through agencies long preceding man and his works, that they seem to have got the habit of survival. For the ground pines—those miniature evergreen trees, those creeping, trailing, green-furred plants of ancient design, bearing each year thin, polleny cones, have been in existence ever since the Carboniferous Period some 250 million years ago. It was the ancestors of today's ground pines, or Lycopodiums, which, as giant Lepidodendrons, grew in the ancient coal swamps and contributed their massive bodies to the formation of coal itself.

Although the majority of species of trees that were living 250 million years ago have long since become extinct, and are known only as fossils and imprints in coal and clay nodules, the Lepidodendrons continued to live. But, although they lived, they grew smaller and smaller, until today's form, which is as it has been for many thousands of years in the post-glacial forests. They are small, compact plants with extensive root systems, plants scarcely more than eight inches high when of erect growth, or lengthily creeping. They are giants in miniature whose yellow spores are cast upon the breeze each brief northern summer.

It is characteristic of the Canadian carpet to have as extensive a root system as a visible greenery, if not more so. The underpinning of carpet plants, in fact, seems far out of proportion to their stems and leaves. Most of them are colonial plants that send up many shoots from one traveling root system. Most plants in the Canadian carpet are therefore difficult to transplant and are better left where they grow naturally. Wintergreen, *Gaultheria*, may be extremely difficult to transplant, but

in the northern woods it lives for years, endures deer munching and logging operations, and stays green the year around. In the same manner of growth is *Linnaea*, the twinflower; *Chiogenes*, the snowberry; *Coptis*, the gold thread; *Trientalis*, the starflower; *Arctostaphylos*, the bearberry, as well as the Pyrolas, Polygalas, and many more. They are an exclusive, select fraternity, these plants of the Canadian carpet.

One of the characteristics of many carpet plants is the fact that they bear colorful or flavorful fruits, or both qualities in one. The north is a land of small berries, and a large percentage grow in the Canadian carpet. The flavor of wintergreen is, perhaps, the typical flavor of the north—and *Gaultheria* with its thick, aromatic, dark green leaves and its pink-red fruits does not monopolize it. You will find that same delicious taste in the tiny oval leaves of the *Chiogenes* that upholsters an old log or a cool embankment, while its little white fruits, which taste like wintergreen-in-cream, are among the choicest morsels in the North. Even the leaves and twigs of black birch are wintergreen-flavored; but we are speaking of the carpet, not of that which grows from it.

Partridgeberry seems flavorless compared with wintergreen and snowberry, but it is one of the charming components of the Canadian carpet and is beautiful the year around. It forms a compact interlacing of oval, dark-green leaves, fragrant pinkish-white, four-parted flowers in June, and bright scarlet fruits the rest of the year, remaining while the next season's flowers are in bloom. Partridgeberry is perhaps most commonly found in the deep shade of pine and hemlock forests. Bearberry, however, grows on dry, often sunny, sandy slopes and among rocks; bunchberry, the dwarf cornel, a miniature dogwood six inches high, is most common in burned-over places in which aspens have come in to reforest and provide shade for young conifers. Here the bunchberry rosettes, which are among the few plants of the carpet that are not evergreen, literally cover acres of ground, including all fallen logs that get in the way. Bunchberry sparkles with symmetrical, four-parted white flowers in early summer, replaced with scarlet boutonniers of fruit in late summer.

Embroidering a bank or carpeting a slope, edging a deer trail, or shawled over the old roots of a hemlock, are twinflowers, Linneaus' favorite. Among Sweden's flowers there are many that are common to the Canadian carpet. Twinflower plants travel with that same extensive rooting, bear compact little scalloped leaves, and thin, two- to four-inch thready stems holding a pair of pale pink bells. A colony of blossoming twinflower in June, perhaps, explains why the great botanist fell in love with this namesake flower. It is one of the most charming sights the North can afford, and the North is a specialist in charming sights.

Accented by ferns and the occasional glisten of a wild orchid—pink moccasins in May and lady's tresses in August—and bound together with the long ropes of trailing ground pine, the Canadian carpet is seldom monotonous. Perhaps, with the exception of the acres of bunchberry, the areas of one kind of plant are so limited or so intertwined with others that the fabric seems endlessly varied. There may be the cool, curly gray masses of reindeer lichen accented by the flame of orange chantarelles; an amanitopsis mushroom springing from a bank of ripe snowberries; mosses like green-gold feathers or white-green cushions, or Polytrichum moss with spore stalks four inches tall. And in a little hollow there may be a snowy cluster of Indian pipe on an August day. The sense of artistic planning is everywhere in the Canadian carpet.

Since the carpet is often so dense and, although low, so protecting to small, scurrying things, the oven bird may build its nest in its shelter. You may find the nest of a hermit thrush, whose blue eggs sparkle near the pink twinflower colony. Chipmunks race under the ferns and bunchberries, so that only a telltale flurry of the leaves announces that something went that way. The young ruffed grouse find ample shelter, and the deer bed down in the cool wintergreen with its white bells in August, and nibble the reindeer lichens.

Summer goes. Although other plants may turn yellow and brown, most of the Canadian carpet stays green. New wintergreen fruits are developing, and when snow comes they continue to grow in its protection. Snow softly stacks high on the carpet, often from October to May, yet the deer may scrape it away to find greenery, and, when the thaw comes and the snow goes at last, the ancient, glacier-laid sand absorbs the run-off. The mats of arbutus, with their rusty old leaves, open pink and white buds as the first flowers of the season to decorate the Canadian carpet.

JACK-IN-THE-PULPIT

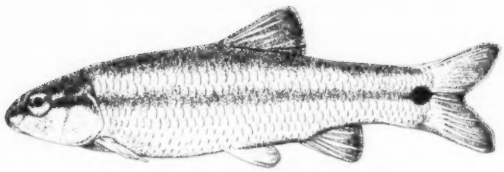
E. F. Heydinger

Jack-in-the-pulpit asleep in his bed,
A blanket of leaves pulled o'er his head.
So deep in his sleep he didn't know
The sun had taken his blanket of snow.

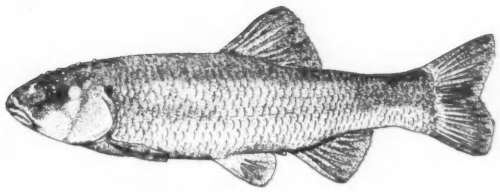
Jack's woodland friends, in wedding bloom,
Mournfully feared his fateful doom.
But the frogs that peep and the birds that sing
Knew Jack as ever was faltering.

So a wifey jay and her raucous mate
Thought they would be compassionate
And scream from a limb just o'er his head
Until he roused and climbed out of bed.

The alarmed Jack soon speared the leaves
And was ordained in the temple of trees,
Vowed to his pulpit to preach and pray
He had the red hat e'er he passed away.



FEMALE HORNYHEAD CHUB



MALE HORNYHEAD CHUB

Minnows

By E. LAURENCE PALMER

This is the eighty-sixth in NATURE MAGAZINE'S *series of educational inserts.*

THE POET John D. Wells, in "A Damper on Discipline," a poem about his son who had run away from the farm chores to go fishing, and who worried his father because he had not returned, says;

"Where's my boy? I whined, an' then
As if in answer there he come
Down the pastcher lane again,
An' headin' straight for us and home—
Steppin' high an' straight an' sta'nch
An' proud as Grant, as like as not—
An' draggin' from a willer branch
The first horndays he ever caught!

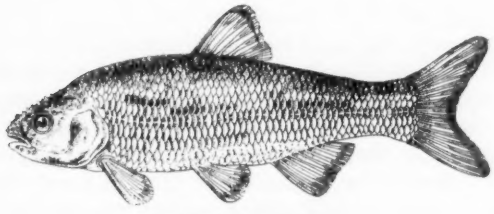
"Where you been? I says, an' looks
Right in his eyes an' there I saw
Pitchers of the fields an' brooks
An' things a young 'un loves! My law,
All my temper left my head,
I throwed the beech gad good an' strong—
Stead o' what I'd planned, I said:
Why don't y' take your pa along?"

This may illustrate well the ability of minnows to bring together human beings of widely divergent ages and interests. In my own case my father and I agreed much more on the joys of fishing than we did on many other things. Minnows surely are, in many parts of the land, the small boy's fish, although it must be recognized that many boys exceed their elders when it comes to the taking of fishes rated more highly than minnows.

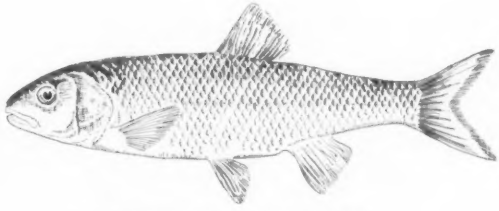
In the third act of *Coriolanus*, Shakespeare elects to disparage minnows, or to belittle one of his characters, when he says; "Hear you this, Triton of the minnows," implying that it is not much to be a demigod to relatively insignificant fish. But if Shakespeare belittles our minnows, that famous fisherman, Izaak Walton, in his *The Compleate Angler*, gives them much more credit than I, for one, would give them, at least so far as fishing for sport is concerned.

If you have not read your Walton recently, take it along with you some time and glance through it again. I am sure that you will enjoy his dry humor, even though he never used a dry fly. Speaking of the apparent recovery of some minnows that had been frozen in the ice, Walton says that it gave him surprise that would equal that of witnessing the resurrection of an atheist. Apparently he repeats "old wives' tales" when he writes about the tench, a minnow, and says that it bears two "little stones" in its head that foreign physicians feel have exceptional medicinal values. Again he tells us of "certain Jews in Rome" who effected a "great cure" of a "very sick man" simply by applying a tench to his feet. I am sure that the famous angler writes much more authoritatively about experiences in catching fishes than when he discusses mystic powers of the finny tribe in the field of medicine.

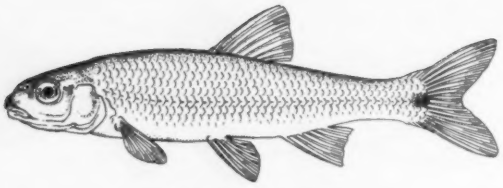
Byron W. Dalrymple is, in a way, a modern Izaak Walton when he writes, in his generally unappreciated *Panfish*, of the art and enjoyment of light tackle fishing for the common fishes of the United States. In these days, when it is becoming almost impossible to catch



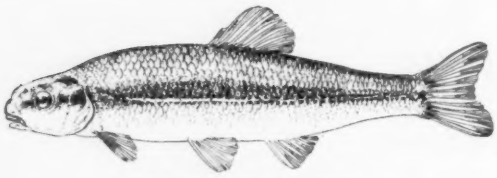
COMMON SHINER



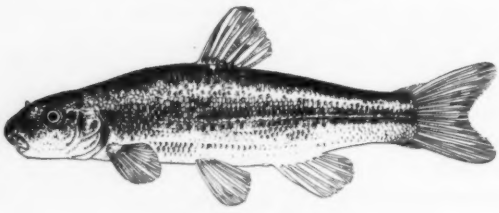
SILVER CHUB, OR FALLFISH



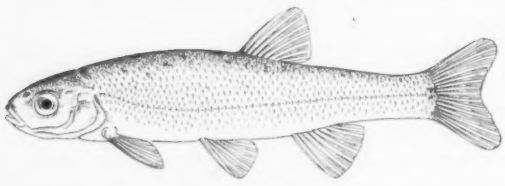
SPOTTAIL SHINER



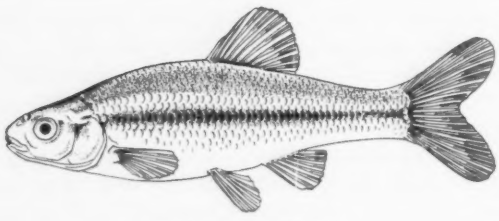
BLUNTNOSE MINNOW



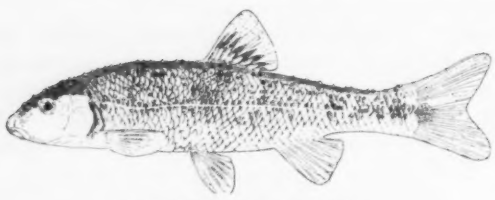
CUTLIPS MINNOW



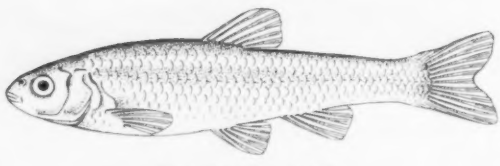
PEARL DACE



FATHEAD MINNOW



STONEROLLER MINNOW



BRASSY MINNOW

many large game fishes, Dalrymple wisely proposes that if we cannot get large fishes with standard tackle we may well take weight from our tackle and thus add stature to our smaller fishes. What's wrong with the idea? If you are interested in having fun in catching fish do not pass up the minnows. Read Dalrymple's chapters on "Our Fresh-water Heritage," "Orphans of the Sporting Angle," and "Midget Department." It may give you a new lease on your fishing life. Surely it will help you have more fun catching more fishes than is otherwise likely through more orthodox procedures.

Many writers have suggested the possibilities associated with catching by various means members of the minnow family. Dalrymple says: "If you want to get some good practice in handling heavy fish on light tackle then carp will give it to you." He, as well as others, point to the new horizon in fishing opened by the revived use of archery in the sporting field, and shows how the shooting of tethered arrows into carp has great possibilities, and may well result in the reduction of the numbers of obviously inferior fishes.

We cannot honestly conclude that the popular conception of minnows as being just small fishes is well taken. Common fallfish are minnows that sometimes reach a weight of three pounds. One of these minnows, a foot or more long, can give a fisherman using light tackle in swift water some real excitement. The white salmon of the Colorado River Basin is really a minnow, yet it may reach a length of more than five feet and a weight in excess of seventy pounds. The rod and reel record for carp in America is forty-two pounds, which exceeds in size the recognized brown trout, cutthroat trout, brook trout and our commoner fresh water basses. Of course there is more fun in catching a two-pound, small-mouthed bass than there is in catching a ten-pound carp. But if we are fair we have to recognize that the minnows are not all characterized by being small.

As is usually the case with any group of organisms represented by a great number of species, it is dangerous to generalize about minnows. One text implies that since the respiration of one minnow is normally at the rate of about 140 a minute, and of a fish in another group is only about 12 to the minute, it can be implied that respiration is more rapid in minnows than in other groups. Respiration, of course, varies with the activity of the animal, with the amount of oxygen available in the water, with the temperature of the animal and of the water, and with other factors. The speed of your own respiration varies greatly, as you know, and a little experimentation with the goldfish in your nearest goldfish globe will show you how, by changing temperature and activity, the rate of respiration may be changed.

Ecologists speak of niches occupied by different kinds of animals. Certainly we cannot generalize and say that all minnows occupy the same niche because they seem to occupy, in one form or another, almost any kind of niche. Some, like our black-nose dace, are found over stony bottoms in swift waters. Others, like our carp, are found over muddy bottoms in still warm waters.

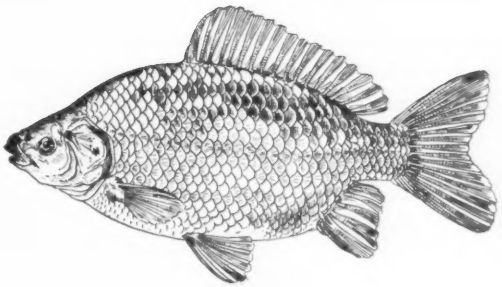
Some are found only in the smaller, shallower brooks; others are found in the open waters of large lakes. A few are found in the brackish waters of streams that flow into the seas. Some favor waters that are heavily limed, while others are found in waters that come from bogs and the like.

Through the year the habitat occupied by members of any one kind of minnow will vary greatly. During the breeding season most of these fishes but not all, will make their ways to shallower, cooler waters than those in which they spend much of their lives. In winter many make their ways to the depths of larger bodies of water, where they remain practically in a state of hibernation.

Some idea of the variation temperature may have on the activities of minnows may be found in what happens with carp, one of our larger minnows. When the temperature of water rises in spring to about 50° F., carp begin to move about freely. However, they do not feed or digest their food readily at this temperature. At 59° F., feeding and digestion begins. Breeding normally takes place at about the time the rising temperature reaches 68° F. When the temperature goes above 77° F., a new period of inactivity begins. As the temperature drops, feeding and digestion practically stop at 59° F. Other species have patterns of their own, of course, and much of the success of fishing may well depend on the fisherman's ability to fit his activities into the activities of the fishes he seeks to take.

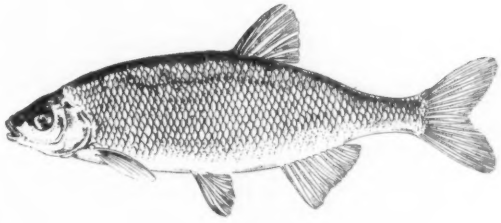
Minnows differ greatly in their means of reproduction, as is shown in the life history charts. Some swim in great schools, depositing their eggs over plants, over mud, or over sand. Sometimes the eggs are nonadhesive, while others stick quickly to almost anything with which they come in contact. Some of the minnows place their eggs under protective stones or boards, and frequently these are protected by one of the parents. Sometimes elaborate nests are built by a male, and sometimes a nest is shared by a number of males. Most frequently females lay their eggs in a nest ruled by one male. Many times the species making the nest may be identified by the kind of materials used in the nest. An understanding of the nesting habits of these fishes is most important to those who wish to raise minnows, possibly for sale as bait. Those minnows that need protection for their eggs must be able to find suitable nesting sites. Many of the minnows that require water flowing over a particular kind of bottom cannot be reared economically simply because these conditions cannot be reproduced easily in a breeding pond. The eggs of many kinds of minnows frequently are eaten by other fishes and protection by an adult may be necessary. Protection against the silting in of the nest may be more important than protection against fish enemies.

Variations in food needs may be critical in the lives of minnows. As the charts show, some minnows feed largely on small animals. This means that these creatures must be present in sufficient numbers to support the highest population. Minnows (*continued on page 256*)

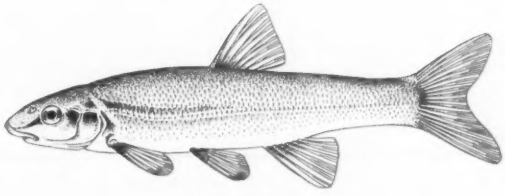


GOLDFISH

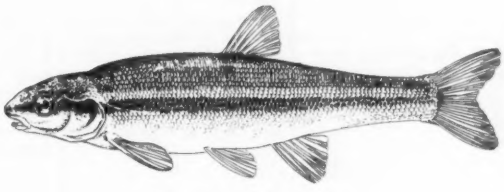
CREEK CHUB, OR HORNED DACE



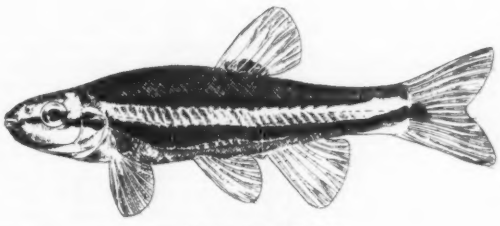
GOLDEN SHINER



LONGNOSE DACE



BLACKNOSE DACE



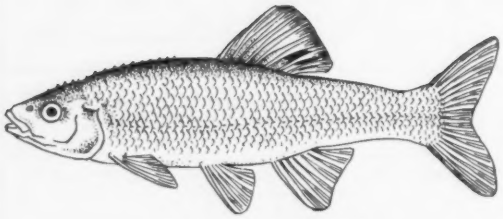
REDBELLIED DACE

COMMON NAME SCIENTIFIC NAME	CARP *Cyprinus carpio*	GOLDFISH *Carassius auratus*	HORNYHEAD CHUB *Nocomis biguttatus*	BLACKNOSE DACE *Rhinichthys atratulus*
DESCRIPTION	Record carp in Switzerland, taken in 1825, weighed 90 lbs.; S. African record, 83 lbs. Rod-reel American record, 42 lbs., in 1930, from Virginia. Carp have 2 barbels at corner of jaw on each side, and first ray of dorsal and anal fins are spine-like. Mostly coarse scaled, soft-fleshed and sluggish. Black above; golden beneath.	Usual maximum length to 15 inches. Weight to more than 4 pounds. Under 30 scales in lateral line. No barbels at corners of mouth. Black, brown, red or white with infinite variations. Great variation in size and shape of fins, shape of body and in type of eyes, some being raised above normal surface of face.	Length to 10 inches. Head large and broad. Dusky to black above and silvery beneath, with large oblique mouth and, in breeding males, with a red spot behind the eye. General sex differences are indicated in the sketches. There are 41 to 47 scales in the lateral line and 18 rows behind the dorsal.	Length to 3 inches. Blackish above, with dark speckles. Black band through eye from snout back along sides. Belly silvery with lower margin of lateral stripe well defined. Scales about 64 in lateral line. Jaws about equal in length. Adult male with little red along black band but with orange pectoral fins.
RANGE AND RELATIONSHIP	Order Eventognathi. Family Cyprinidae. Native of Asia. Introduced into Europe 1227 from China, and successfully into America in 1877. Widely distributed from Washington, D.C., in 1879. Now in all States, except possibly Maine and Florida. Leather carp is scaleless; mirror carp has few large scales. Typical carp well-scaled.	Order Eventognathi. Family Cyprinidae. Native of Asia, but introduced on a world-wide basis for aquarium use. Established in waters of Great Lakes and their tributaries to the south, particularly in Lake Erie. Favors areas with weeds over mud bottoms. Closely related to carp with which may cross.	Order Eventognathi. Family Cyprinidae. Ranges from North Dakota and Colorado east to the Hudson River and south to Oklahoma. It favors large creeks or small rivers with swift water flowing over bottoms of gravel. In some literature, it appears under the genus *Hybopsis*.	Order Eventognathi. Family Cyprinidae. Ranges from New Brunswick and the St. Lawrence River system south to Georgia and west through Alabama, Iowa and North Dakota. At best in small, clear brooks with stony bottoms and swift water, where it may be found among the stones in riffles.
REPRODUCTION	In latitude of New York breeds May and June in schools in shallows, a 16-lb. fish laying to 2,000,000 adhesive eggs, which are unprotected. Hatch in 5-12 days depending on temperature, may reach 9 inches in one year and mature in 2-3 years. During breeding antics may leap from water repeatedly and roil water.	In April and May when water temperature reaches to 70°F. pairs may mate in early morning to early afternoon with female laying 10-20 amber eggs at a time. These adhere to plants. Female may lay to 500 eggs, which hatch at 70°F. in 3-7 days. Good breeder has to 2-inch body, breeds at age 2-9 years. Life span to 25 years.	Spawns in April and May in water to 2 feet deep at 65°F., or warmer, at the head of gravelly riffles. Males build a pebble nest, and eggs and pebbles become mixed. Nest may be to 6 inches deep and cover a number of square feet. A number of females and some shiners may lay eggs in nest. Several years to maturity.	Spawn in April and May, when dark stripes of male may become orange or tan and pectoral fins similarly colored. Male builds nest over sand and gravel and squeezes eggs from visiting female, although this may be off the nest. Water temperature 75°F. at breeding time. Eggs about 1/16-inch in diameter, quickly swelling to ⅛-inch.
ECOLOGY	Food primarily any organic stuff, plant or animal, including fresh fish eggs. Migrates to shallows in May and July. An average 10-inch fish weighs ½ lb.; 12-inch, 1 lb.; 16-in., 2 lbs.; 18-in., 3 lbs.; 20-in., 4 lbs.; 24-in., 8-lbs., 2 years old; 26-in., 10 lbs.; 32-in., 15 lbs., 8 years old.	Thrive best in water containing lime, with best development between 55-70°F. Female may lay to 14,000 eggs in a lifetime after maturing at about 4 to 5-inch length. An 11-inch fish may weigh to 9 ounces, and an 18-inch fish may weigh to 3 pounds. May lose color if living in natural habitat.	Food mostly insect larvae and other small animals. About 30% midge larvae; 14% algae; 12% mayflies and 24% aquatic beetles. Only a small percent is of mud and silt so it is obvious that it may be difficult to rear this species in artificial rearing ponds. Slow growth also makes it unpopular in this respect.	Food chiefly small animals, as 70% midge larvae and 17% mayfly nymphs, or sometimes fish eggs where available. A good forage fish for trout, but a direct competitor for food and sometimes an enemy of eggs in nests. July young average 17½ mm. and weigh .09 grams; one-year young average 35 mm. and weigh .7 grams.
ECONOMY	Destroyer of nests and eggs of more valuable species. 250 tons harvested annually in New York State as cheap food and to protect more valuable species, but ineffective. Considered pest. Makes good bait minnow but use prohibited in many States to limit spread. Cooked properly is considered edible by some. Good fighter on line.	Popular aquarium fish of the hardiest type. Essentially a scavenger, eating almost any organic material. Of little value except as an aquarium animal. May be used successfully as bait minnow but danger of escape should be avoided in waters supporting valuable game fishes. Reared profitably in ponds heavily fertilized 2/3 sheep manure, 1/3 superphosphate.	One of the best bait minnows because it is hardy on the hooks and in storage tanks where the loss is remarkably small. It is particularly popular as a bait for catching bass, catfish and walleyed pike. It is quite significant that data on rearing costs and practices in rearing ponds are meager or lacking.	Used as bait for trout by fishermen. Caught in traps or seines. Useful primarily as a forage fish for trout in spite of competition offered. Makes a most interesting aquarium fish because of great activity, but requires a high oxygen content in the water and relatively low temperature to succeed.

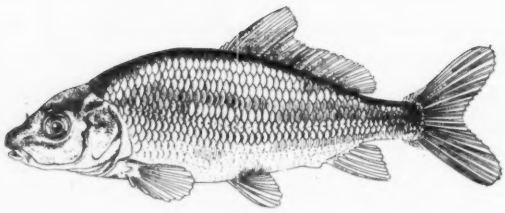
Longnose Dace *Rhinichthys cataractae*	Silver Chub, Fallfish *Semotilus corporalis*	Creek Chub, Horned Dace *Semotilus atromaculatus*	Pearl Dace *Semotilus margarita*	Redbellied Dace *Chrosomus erythrogaster*
Length to 4 inches, but usually not more than 3. Upper jaw much longer than lower, and mouth horizontal and "shark-like." Eye nearer center than upper part of head. Olive above with numerous dusky areas on sides, and whiter below with margins of dark areas fading gradually. About 65 scales in the lateral line.	Length to 18 inches for males. Brown above to olive on sides and lighter beneath. Dorsal with 8 rays and no dark spot, set slightly behind mid-body and directly above pelvic fins. Anal fins with 8 rays. Scales silvery and about 48 or less in lateral line, which is almost straight. About 22 in front of dorsal fin.	Length to about 11 inches. Body stout. Mouth large. Dorsal inserted behind pelvic fins. with dark spot at base. Dusky blue above. Sides with vague dusky band. Belly cream. Head blunt, with 4 large tubercles on top in breeding season. Scales crowded before dorsal, with 55-65 in lateral line, which curves up forward	Length to 7 inches, but usually about half that length. Heavy body, short head, blunt snout. Dusky olive above with faint lateral stripe darker. Lighter on sides and lightest beneath. Mottled with darker scales. Scales small but visible.	Rarely more than 3 inches long. Brown with 2 horizontal stripes on sides. These join before tail. Silvery between stripes. Fins canary-yellow, with dorsal with scarlet band. Scales fine. Eyes large. Mouth small. Body cavity lining black. Intestine from 2 to 4 times length of body.
Order Eventognathi. Family Cyprinidae. Related, of course, to Blacknose Dace. Found in fast water and along cool lake shores. Ranges from coast to coast in North America in the general latitudes of the Great Lakes. Extends south to South Carolina and northern New Mexico.	Order Eventognathi. Family Cyprinidae. Ranges from northern tributaries of James Bay and the Maritime Provinces south to eastern Alleghanies into mountains of Virginia. Definitely prefers clear lakes and streams. Is closely related to the Creek Chub or Horned Dace.	Order Eventognathi. Family Cyprinidae. Ranges from Red River of North country and Manitoba east to Gaspe Peninsula in Canada, and south to South Carolina, Georgia, the Ozarks and New Mexico. Usually in clear, cool, headwater streams, commonly associated with Brook Trout, White Suckers and Black-nose Dace.	Order Eventognathi. Family Cyprinidae. Has been included in genus *Margariscus*. Northern pearl dace found from Rocky Mountains to Maine and north into the tundra. Best known in United States probably in Dakotas, Minnesota, Wisconsin. Not reported in the tributaries of Lake Superior. South to Virginia in East.	Order Eventognathi. Family Cyprinidae. 3 species, closely related, range from British Columbia to New Brunswick and south to Colorado, the Dakotas, Minnesota and Maryland. Southern forms are longer and have more horizontal mouth. Prefer cool gravelly creeks
Breeds May and June, when body of breeders becomes covered with small tubercles, and fins of males become suffused with red. Males also show crimson on lips, cheeks and lower fins. At 1 year males are to 2.4 inches long; at 2, 2.9; at 3, 3.2; at 4, 3.6 inches. Females at 1, 2.3; at 2, 3.; at 3, 3.3; at 4, 3.7; at 5, 4.2 inches.	Breeding males develop reddish fins and in season select nest site in a stream and build a somewhat circular pile, which may be 6 feet across and 3 feet high, using small stones as material and taking a week for construction. Spawn on downstream side of nest and eggs may be partly covered in building act.	Breed April-July in swift water in riffles where purplish and rosy male digs a pit above a riffle, dropping sand and gravel upstream in ridge to 15 inches long. Fights other males. Spawns in pit. At 10 weeks may be 2 inches long; at 12, 3; at 18, 4; at 1 year, 5, and at 2 years, 7 inches long.	In breeding season in early spring male has red band along under side but no black on fins and no tubercles. May be highly colored from February but this fades by fall. Eggs usually laid in fine sand or gravel, usually in running water. One female 4½ inches long yielded 1686 eggs and young may reach 3½ inches first year.	Spawn from May to August, breeding in lakes, ponds and forested swamps in shallow water among plants in North and on sand in South. Female lays 5-30 nonadhesive eggs, which, at 70-80°F., hatch in 8-10 days. Female breeds 2 times a year with early young maturing 1st season and late the next.
Food is almost wholly animal matter, particularly insects, so the species is a direct competitor with game species for food. However, it is a valuable forage fish for larger game fish, although it would be better if it fed on non-competitive plant materials. It occupies territory similar to many game species' favorites.	Food is primarily insects, crayfish, worms and small fishes so may serve as a competitor for food with more valuable game species, such as trout that are found in similar waters. May take an artificial fly and may provide a good fight to the fisherman who hooks one. Mouth is usually rather tough.	Food commonly insects, crayfish and small fishes so is direct competitor with game species. Usual food over 50% insects and 26% surface drift. Heavily stocked ponds may yield 2¼-inch fish in 14 weeks if food problem can be met. 2-inch fish number 300 per pound; 3-inch, 90 per pound, and 4¾-inch, 18 per pound.	Favors small brooks, lakes and bogs where water is clear and cool. Feeds mostly on insects, but known to eat plankton, small mollusks, water mites and surface organic material. Its food undoubtedly varies with the nature of its environment, which may vary considerably.	Food is plants and small animals, but by far the greater proportion of the food comes from algae and diatoms gleaned from the surface of submerged stones. At best in cool waters such as are inhabited by Brook Trout, which frequently feed in turn on Redbelly Dace.
Makes a good bait minnow and an excellent small aquarium fish, but it does not survive well in the crowded conditions found in a bait bucket, or in a rearing pool, nor does it yield well to artificial breeding ponds.	In the Delaware and Susquehanna River systems in New York and Pennsylvania these fish may be a nuisance to fly fishermen, who naturally prefer other species. Fallfish are good bait minnows, and are hardy in the bait bucket and on the hook. Popular with bass and pike fishermen within range. Not easily raised in pools.	Pools may yield 134,772 fishes per acre where raised as bait. Brings top price as bait minnow because of hardiness on hook and in bucket. Normal mortality in ponds may be 25-50%, largely because of food problem. The ideal fish for small boys with cheap tackle. Edible but decidedly bony.	Excellent forage fish providing food for larger game species. Excellent bait. Hardy in crowded pails and can survive low oxygen content of 1/5 of 17 parts per million. 4 gallons were carried 2 hours in 5-gallon container at 40°F. without loss of a fish. Recommended to dealers with little working capital. Bait size in a summer.	Under cultivation in ponds may be made to yield 125,000 fish per acre. Not a competitor for food with associated game species. Hardy in bait buckets and generally considered as a fair bait minnow among all the kinds commonly reared for sale as bait. Usually used as bait for the common small panfish.

COMMON NAME SCIENTIFIC NAME	GOLDEN SHINER, ROACH *Notemigonus chrysoleucus*	SPOTTAIL SHINER *Notropis hudsonius*	COMMON SHINER REDFIN SHINER, *Notropis cornutus*	SATINFIN SHINER, SILVERFIN *Notropis analostranus*
DESCRIPTION	Length, to 12 inches. Lateral line rather conspicuously parallels lower profile of body. Belly behind pelvic fins with 11-15 rays. Head small and pointed. Clear green above, with sides silvery, with golden reflections. Fins yellowish. Young silvery.	Length to 6 inches. Pale with broad silvery band along sides and faint or dark spot at base of tail, and a dark spot at base of dorsal. Anal fin usually with 8 rays. Eyes large. Scales not crowded between head and base of dorsal. With about 59 scales in the lateral line. 18 scales between dorsal and head. Muzzle blunt.	Length of males to 8 inches. Dark steel-blue above, with a gilt line along back and gilt lines along sides. Silvery on sides and belly. Male larger than female. Scales deeper than long with more than 20 between head and dorsal and 37-40 in lateral line. No barbel. Body strongly compressed. 9 rays in anal.	Length to 4 inches. Male bluish but female silvery. Paired fins white. Edges of scales dusky with 34-33 scales in lateral line. With a large dark spot on the upper rear portion of the dorsal fin. 9 rays in anal fin. Head about as long as body is deep and depth of body about ⅓ the length.
RANGE AND RELATIONSHIP	Order Eventognathi. Family Cyprinidae. Ranges from New Brunswick to Manitoba and south to Texas, Tennessee and Florida. Found often abundantly in ponds and slow streams where there is abundant vegetation. Common name of Bream is applicable to these fishes. Formerly considered in the genus *Abramis*.	Order Eventagnathi. Family Cyprinidae. About 100 species in the genus. This one ranges from James Bay in Canada to the upper Great Lakes, and south to upper Mississippi and the Hudson and Susquehanna systems. Often found congregating in large schools near shores of lakes and rivers.	Order Eventognathi. Family Cyprinidae. Ranges through most of continent east of Rockies, except in Texas and along Atlantic south of Neuse River. Northern limit in Saskatchewan and southern limit the Gulf of Mexico. One of commonest minnows in most creeks of eastern North America, where it seeks open sunny areas.	Order Eventognathi. Family Cyprinidae. Found abundantly locally in clear streams from Lake Ontario south to North Carolina, and in closely related forms west to Oregon. Related Spotfin has 8 rays in anal fin and 39-42 scales in lateral line.
REPRODUCTION	Breed May to August, when males develop red abdomens. Female lays 5-30 nonadhesive eggs at a time on roots, plants or algae, which, at 70-80° F., hatch in 8-10 days. Probably 2 spawning periods. Silvery young may reach 3 inches in 5 months under ideal conditions. Normally 1 inch, 5 months; 1½-2, in 1 year, 9-inch fish, 9 years.	Spawn in May and June along sandy lake shores, usually near mouths of tributary streams, or even up the streams a way. Grow ½ mm. a day for 1st month. By July may be more than 1.5-in. long, 1st year become to 1¾ inches long; 2nd year, to 2¼ inches; 3rd year, to 3 inches. Young left to shift for selves without any parental care.	Breeding males from May to August may have salmon-pink bellies, and lower fins and tuberculate bodies forward. Eggs laid at 73° F. in swift water, usually in pebble nest built by males and over shallow gravel. Male protects eggs and nest. Young with dark band along sides. In ponds fish may breed near intake.	Breeds in late spring, such as May and June, in shallow waters of lakes or near the mouths of streams, usually in considerable numbers. Relatively little known about early stages, or about breeding habits. At least, information not to be found in most literature.
ECOLOGY	Normally 90-95% of food is plants, but 35% may be insects; 28% plankton; 14% algae and 12% crustaceans. 14 known parasites. Young of year have dusky lateral stripe. 4-inch fish weighs ¼ ounce; 6-inch, 1; 8-inch, 2½, and 9-inch, 4 ounces. Non competitors for food with common game fishes and a valuable forage fish for them.	In winter goes to deeper waters of lakes. Food is primarily small, free-swimming crustacea and other minute animals. May include some plant material as well, but most of the food is taken from open water rather than from the bottoms or from the surface, as is the case with some minnows.	Food mostly insects but may average 40% plants, 37% insects; 12% plankton; 7% other fish. 3 known parasites. In pond may reach 2 inches, 1st year; 2-4, in 2nd; 3-5, in 3rd, reaching maturity in 2-3 years. Grows ½ mm. a day for 1st month. Not as prolific in ponds as some other bait minnows.	In winter may make way into deeper waters as is common with many other minnows. This species may be found in the tide-water areas of some of the larger rivers flowing into the sea, and since it is a good bait minnow may be collected for that purpose.
ECONOMY	One of best bait minnows, hardy on hook and in pail. May be used as panfish, but flesh soft. ½-acre pond fertilized with 464 pounds cottonseed meal at cost of $8 yielded 204,082 fish at cost of $.018 per pound. 1 acre stocked with 200 fish yielded 65,000. Breeding ponds may support 250,000 golden shiners per acre.	A most important forage fish providing food for larger and more valuable game and food species. Makes a good bait minnow, particularly for Muskellunge, Pike, Pickerel and for Yellow Perch. Is not too hardy in the bait bucket or in storage tanks. Named originally by Gov. DeWitt Clinton of New York State.	Popular small boy's fish. Difficult to raise in ponds because of food problems, but because of brightness and activity makes high priced and excellent bait minnow. Also makes a good aquarium fish. May take artificial flies as do trout. Flesh is good to eat but is bony.	This species is widely used in Virginia as a superior bait minnow. Of course, it serves the basic function of converting small organic materials into suitable food for the larger fishes that use this species as food.

BRASSY MINNOW *Hybognathus hankinsoni*	FATHEAD MINNOW *Pimephales promelas*	BLUNTNOSE MINNOW *Hyborhynchus notatus*	CUTLIPS MINNOW, NIGGER CHUB *Exoglossum maxillingua*	STONEROLLER, DOUGHBELLY, ROTGUT *Campostoma anomalum*
Length to 6 inches. Large scales that rub off easily, with many weak radii. Scales crowded behind the head. Head blunt. Fins rounded, short, with free edges. Mouth small. General color silvery or brassy, as distinguished from the brilliant silver of Silver Minnow, which may be more slender.	Length to 3 inches. Body short and relatively deep. Dark olive above and coppery or purplish forward. Dorsal fin with dusky crossbar at middle, or over lower 2/3 in breeding males. Mouth terminal and oblique. Anal fin with 7 rays. Lateral line incomplete, with 43-47 scales. Intestine 2-3 times body length.	Length to 4 inches. 1st dorsal fin ray thickened. Broad head. Inferior mouth. Small scales crowded in front of dorsal. Dark spots on body in front, at middle of dorsal and at base of tail. Body cavity lining black. Intestine 2 times length of body. Breeding male dark with black band through dorsal fin.	Length to 8 inches. Dark compact body. Olive above, with purplish reflections on the sides and lighter beneath. Breeding male may appear to be excessively dark. Lower lip is characteristically 3-lobed and relatively short, and on under side of head, also considerably shorter than upper lip. Fins plain.	Length to 8 inches. Females usually less than 5 inches. Stout-bodied. Brassy above. Sides blotched or mottled with black. Scales long, may be black-flecked, with 55 in lateral line. Belly white. Breeding male with black bar through middle of dorsal. Abdominal cavity black-lined. Long intestine coiled around air bladder.
Order Eventognathi. Family Cyprinidae. Ranges from Montana east through Great Lakes area to Lake Champlain and south to Colorado, Kansas and New York. Also reported from many tributaries of the Mississippi. Most close relative is the Silvery Minnow, *H. nuchalis*, which has about the same range.	Order Eventognathi. Family Cyprinidae. Ranges over eastern North America from Hudson Bay and the Maritime Provinces south to Maine, New York, Ohio, Tennessee, Kentucky, Kansas and Colorado. Known sometimes as Blackhead Minnow because of dark forward parts.	Order Eventognathi. Family Cyprinidae. Ranges from Winnipeg through Great Lakes area to Quebec and south to Virginia and the Gulf States, west to Nebraska. In Michigan area this may be the commonest of the minnows. Dorsal fin with 9 rays; anal with 7. Lateral line with 45 scales.	Order Eventognathi. Family Cyprinidae. Ranges from the St. Lawrence River system south to Virginia usually east of the Appalachian Highlands. Not a widely distributed species as compared with most other minnows. Not much if any west of Lake Ontario. May be locally abundant.	Order Eventognathi. Family Cyprinidae. Found in streams and lakes, commonly over mud in weeds close to shore, ranging from the St. Lawrence system through the Great Lakes to Minnesota south through upper Mississippi River valley and into Mexico. A number of subspecies recognized in range area.
Breeds from April through July, with the female laying adhesive eggs that are scattered over mud, twigs and debris at temperatures of 50-55° F. Growth is slow and it may take 2 years to develop a fish from 2½-3 inches long. The breeding habitat varies with the region occupied.	Breeds in May to mid-August in shallow waters of lakes, ponds and swamps, usually over shingle of fine gravel at 64° F. Eggs laid on under side of objects, guarded by male with 36-1200 eggs in a single nest. One female produced 4144 young in 11 weeks in 11 spawnings. Eggs hatch in 4-6 days. 1 inch, in 1 month; 2, in 3.	Spawns May to August, with males almost black. Breeds at 70° F. in water to 8 feet deep to 6 feet over shingle, in nests under stones or boards with average nest containing to 2500 eggs. Female breeds twice in a season. Young at 1 year, 2¼ inches; at 2, 3 inches. Maximum age to 4 years. Less prolific than Fathead Minnow.	Breeds May and June, when males build pebble nest in water 3 to 30 inches deep and 8-12 inches across in or at head of riffle. Male guards nest, which may be visited by many females. Male has no breeding tubercles. Avoid competition with interlopers but fights other males. Eggs 1/10-inch, yellow, glossy; hatch in 4 days.	In breeding from April through mid-June, male digs cup-like depression above riffles in water usually less than 3 feet deep. In breeding season male has tubercles on head, bright brassy color on body, dark and orange bars across the dorsal, orange eye and orange on pelvic fins. Young reach maturity in 2-3 years.
Found in bogs, creeks and lakes and small streams. Food may average 32% plant plankton; 30% animal plankton; 21% insects; 16% surface debris; 3% plant materials and 2% silt. The mud-eating habit is reflected in the intestine, which is 2-3 times the length of the air bladder and coiled like a watch spring.	Largely a mud-eater favoring plant foods, but sometimes eating fish eggs. Tolerates muddy water more than many species. Known to have 2 parasites. Food may average 35% plant plankton; 12% sand and silt; 12% surface food and 6% crustaceans, with rest miscellaneous.	Favors lakes and rivers with firm bottoms and some rough material. Food primarily plants, crustacea and insects; 35% plankton; 12% silt; 11% surface drift; 16% insects; 9% plants. May be an important food for larger fishes. Known to support at least 9 parasites. Male builds nest and guards the eggs at breeding time.	Normally found in small, swift streams over gravel bottoms. Essentially a bottom feeder but has been taken on a fly. Food largely insects, snails, worms, crayfish. Lower lip used in removing food from stones that have been rasped by upper lip. Nest abandoned in 6 days when young leave after 4-day incubation at 70° F.	At best in clear gravel bottomed brooks. Can withstand relatively warm water. Food largely plants with to 60% algae and diatoms gleaned from stone surfaces, 30% mud and sand and to 10% insects possibly taken incidentally with mud and sand. Obviously largely a mud-eater.
Makes a good forage plant for larger and more valuable food and game fishes. Makes an excellent bait minnow and is frequently reared in artificial ponds. An acre of well-managed pond may in a year yield to 35,200 of these popular bait minnows.	Good forage fish and food for trout. Used as bait but not too hardy in containers. 1 acre of managed pond may yield 200,000 minnows weighing 328 pounds with number varying largely with fertilization and food available. Stands crowding in ponds remarkably well. Brush sunken in breeding ponds supply supports for the eggs.	An excellent bait minnow but does not withstand too much crowding in containers. Can best be propagated as a slow grower but ponds may yield to 100,000 fishes a year and as high as 473,350 per acre have been raised in Ohio. Pond fertilized at rate of 640 pounds cottonseed meal per acre yielded 530 pounds of minnows.	Sometimes considered an important bait minnow but does not yield to raising in ponds because of nesting requirements. Hardy on hook and in containers. Serves general purpose of being food for larger game species and may also serve as enemy of the species in the destruction of nests.	An excellent forage fish for larger game species of habitat, with which it does not compete for food. Has no food value to man. Is of minor importance as a bait minnow but may be favored by Black Bass. Is hardy as aquarium fish, but does not breed well in artificial ponds because of need of running water over nest.



SATINFIN SHINER



CARP

(*continued from page 251*)

that feed on plants are much more likely to survive overcrowding since plants are usually more abundant than are animals. Those minnows that feed largely on algae and the diatoms, such as those that form slimes on submerged rocks, find an almost inexhaustible supply of food. It is relatively simple to raise these fishes. This is particularly true if the abundance of these plants may be increased by the use of suitable fertilizers. The charts show the specific food needs of some of our minnows.

When this insert first appears in print it is quite probable that one of the chief points of public interest will be the food problem, nationally and internationally. Our mid-West food belt has tremendous political influence, and both of the major political parties, soon to select candidates for the fall elections, will be courting support from that area. Of course, we do not eat farmers, but without farmers we do not eat. Farmers are able to process the sun, rain and soil into corn and wheat, and to process the corn and wheat into dairy products, and into pork and beef. The product of the farmer is, in turn, processed at the will of the labor leaders into food products that reach the dealers who supply most of us with what we put on our tables and, eventually, into our mouths. Somehow in this chain of events many of the farmers have not been able to prosper. This is particularly true of those who have relied on antiquated methods associated with their labors. The major farm organizations have recognized merit in the private enterprise system and seem to resent manipulations of their economy that may limit their earning power in many ways. Logic makes it difficult to justify the expenditure of public funds for the erection of huge dams to produce food, the profitable sale of which depends on fixed price supports. Somehow a solution will be found, of course.

If our national and international food problem is a complicated one, the same holds for the food economy of our waterways, where our minnows may play an important role. We cannot consider all minnows as having similar problems and similar potentials any more than we can consider all farmers as being alike.

Our minnows are, like farmers, largely early processors in the whole food chain. Basically, of course, the water plants process air and water into plants. These plants, either suspended in the water, possibly as plankton, or anchored to the bottom, are eaten by fishes, many of which are minnows. These fishes process the plant material into food acceptable to many of the more valuable food and game fishes. The successful management of a body of water may depend on using fishes that can, with a minimum use of time and space, produce a maximum of flesh acceptable to the more valuable fishes as food. This means that minnows that compete with the larger fishes for food are not so valuable as minnows whose food is not favored by the food and game species. Our chart section will give many details supporting this idea, particularly in the last sections where problems associated with rearing minnows are given emphasis.

Other problems associated with the food chain of which minnows are a part take into consideration such things as temperature, water turbidity, light, chemical nature of water, parasites, pollution and presence and abundance of enemies. Conditions suitable for the prosperity of a fish must be present during its life time, even though these conditions will vary from time to time during the day, or from time to time during the year or during the years necessary for the fish to reach reproductive maturity. As suggested for the carp, many fishes are able to meet these changing conditions by suspending their activities, including their digestive needs. Our waterway economy could no more do without minnows, or similar fishes, than our national economy can do without farmers. The minnows in many areas produce a major portion of the bulk of food used by the most important fishes.

The management of this minnow supply in a waterway system sometimes calls for more care than might seem necessary. If we have a lake that yields a valuable fish resource the chances are good that those fishes are dependent largely on the minnows and similar fish that start their lives in the shallows, or in the tributary streams. If we seine these areas consistently we remove the natural food supply from the lake and our desirable fish population becomes reduced. Under these circumstances we must either control the seining activities or rear fishes under controlled conditions. As a matter of fact, we do both. In many parts of the country it is illegal to take bait minnows from natural areas. In more parts of the country we are learning how to use farm ponds for the production of superior bait minnows that cost little to produce, are hardy in containers and on hooks, and remain attractive when put on a hook. Usually this is most easily done with minnows whose food supply can be produced cheaply and abundantly.

The Mystery of Keyhole Canyon

By NELL MURBARGER

Photographs by the Author

STILL unexplained is a mystery cache of Mayan-type idols and other Stone Age artifacts found seven years ago in a shallow cave in Keyhole Canyon, on Nevada's southern tip. Far removed from any point of habitation, the canyon had been visited by comparatively few white men prior to the February day in 1948 when members of Clark County Mineral Society selected it as their target for a weekend field trip.

After exploring the steep walls of the gorge and the picturesque rock formations common to the area, members of the Mineral Society had turned their attention to the remarkable display of Indian petroglyphs, which blanket many large boulders near the canyon's mouth and solidly cover the sheer cliff faces to a height of more than forty feet.

A clay water jug thirty inches in height taken from a cave in Keyhole Canyon, in southern Nevada. At the left, some of the thousands of Indian petroglyphs, or rock carvings, that decorate the cliff faces of the Canyon.

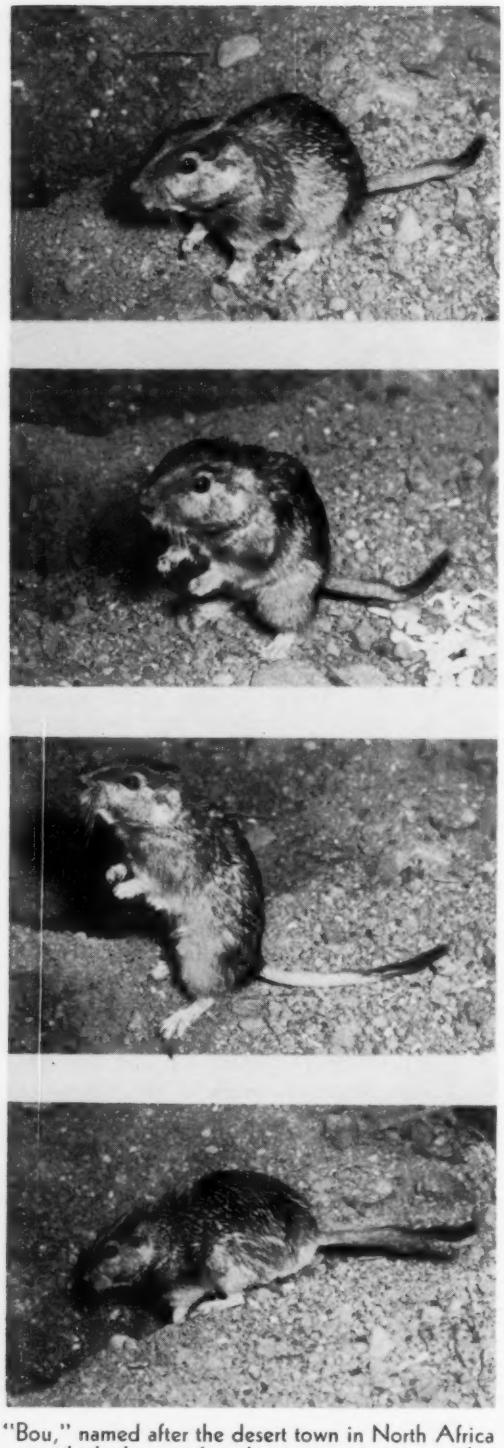
While examining the ancient symbols, Paul Mercer, of Boulder City, Nevada, then president of the society, had noted a shallow cave near the base of the cliff. Thinking there might also be Indian writings on its interior walls, he wiggled through the low aperture.

By the time his eyes had grown accustomed to the half-dark of the small stone pocket, Paul Mercer had lost all interest in Indian writings for his gaze had fastened on a strange object two-thirds buried in the deep sand that floored the cave. Summoned by his excited shout, three waiting companions swarmed into the cave and all began digging feverishly, scooping the dry sand aside with their bare hands. Before the article first glimpsed had been wholly uncovered, another had been exposed to view; and within an hour had been unearthed several hundred pounds of the most amazing and mystifying Stone Age art ever found in Nevada!

Typically pre-Columbian, and resembling most nearly the work of the Mayan and Tarascan Indians, of Mexico, the lot included fifteen handmade pieces, some beautifully polished and all elaborately decorated, either by intricate carving or by overlays of coiled clay. Largest and most unusual piece in the collection was a thirty-inches-high clay water jug, modeled in the form of a man's head and torso, while the largest stone relic was a Mayan-type human-form idol, twenty-two inches in height, and carved from a solid chunk of basalt.

Since making his strange discovery, Mercer has spared neither time nor effort in attempts to classify the pieces and to learn why they should have come to light thousands of miles from their normal home in Southern Mexico.

But nothing has come of all that research. Neither has any additional piece been reported found in the area, and the Mystery of Keyhole Canyon remains unsolved.



"Bou," named after the desert town in North Africa near which she was found, is uncertain as to what to do about the two whispering people maneuvering around her. She pauses, sits up, stands almost erect, then starts to enter her hole, slowly and doubtfully.

DESERT COUSIN of the WOODCHUCK

By GEORGE BALLOU

Photographs by Barbara Ballou

It was springtime and my wife and I were in Casablanca with a motor scooter, plenty of free time ahead of us, and a desire to meet certain fourlegged Moroccans.

Soon after we had left the city behind us we were in a territory of magnificent scenery. The thickly forested mountains of the Atlas Range contrasted with the bare treeless vastness, sandy lowlands and miles of undulating hillocks jagged with rocky debris. The scooter was nearly hidden by ourselves and knapsacks, bags and other gear. "You can't strain the scooter that much!" a Casablancan mechanic had warned, amazed that we had reached his garage, let alone planned a trip of many hundred miles.

Without mishap we reached the northern fringe of the Sahara, and, after many hours of driving against the sun and wind, stopped near a Moorish village named Bou Izakarn. The roadside was bordered by a long flow of pale sand with many mounds topped by small bushes. One nearby mound was pockmarked with mysterious holes that demanded investigation. Barbara chose a comfortable seat nearby, while I opened the folding shovel and went to work.

A brown something shot from the hole. I grabbed him and he grabbed me. There was a rodenty squeal mixed with my "Ow!"

That is how we met our first *Psammomys*, or in full *Psammomys obesus*, a stocky, rat-sized rodent inhabiting the deserts of North Africa and points farther east.

We put our catch into a perforated, wire-covered can. First glance showed him to be a large male. His crown was reddish, his back brownish and his undersides yellowish. The tail was tufted. Some species are a pale yellowish-orange with rippling silken fur. Although thousands of miles from the American farmland, he was reminiscent of the woodchucks that live near gardens there. He had the same small ears and a similar profile to the head. He sat up like a plump gentleman-farmer whose food is grown by someone else. Actually *Psammomys* burrows into a mound held in place by the roots of a bush, the edible shoots and twigs of which are cut into convenient lengths and stored in his provision chamber. But the likeness to our groundhog stopped

with his tail, disgracefully long for a woodchuck.

The rodent made a fine whistle, drummed his feet on the can's bottom and sat up and washed himself. Rubbing his hands before his mouth, he drew down his whiskers, pulled his arms over his shoulders and sides and dusted off his tail. Luckily for his companionship, we caught a female *Psammomys* nearby, two-thirds grown and full of spirit. In memory of their birthplace near Bou Izakarn we named her Bou and him Isaac. Two days later Bou took food from our fingers and submitted to being petted without whistling and scratching.

The long road home lead all the way from Bou Izakarn to Zurich, Switzerland, meaning vast changes in temperature, humidity and altitude. If the pair survived these sudden changes there was still another factor to worry about. We had read that *Psammomys* were hard to keep in captivity, partly, it was believed, due their need of a certain salty element present in their desert diet of twigs and greenery with a high liquid content. One naturalist had caught many *Psammomys* and given them ample greenery and liquid, including camel's milk. Yet most had died.

Two hundred miles later we had become so familiar with Bou and Isaac that we refused to believe they could die, and soon forgot their heralded sensitivity.

Weeks later we arrived in Zurich, where the *Psammomys* duo became the most charming pets, and their semi-diurnal habits made observation and contact all the easier. Apples, carrots, lettuce, hard bread and boiled potatoes formed the backbone of their diet. One naturalist recommended beets, oatmeal and coastal marsh grass.

The moment we entered the room they jumped back and forth begging to be let out of their cages. We opened the doors and out came their heads, whiskers a'quiver. A miniature ladder was hooked to the lower rim of Bou's cage, it being high off the floor, and she descended slowly and tensely. Once on the floor, she always went sightseeing, inspecting corners, the radiator, our feet, as though it was her first trip below. She caused many squeaks and near fights when she disturbed the inhabitants of other cages by scratching at the wire backs.

One evening Bou descended the ladder as usual, but, on touching the floor, ran behind the cage. "She must be startled," said Barbara. Before I could answer, Bou had dashed back, nudged my hand and half-heartedly pretended to bite and scratch it, then scampered away uttering that remote whimsical whistle. Taking the hint, I chased her with my hand and it became a game. Eventually Isaac played in this fashion, but being older and more sedate he did so as if it were not quite correct for a *Psammomys* of his age.

The tourist trip over, Bou approached the foot of the ladder, climbed halfway up and then ran the last stretch. Once home she whirled around and looked down, as though praising herself for daring such heights. *Psammomys* are strictly terrestrial, so Bou was an adventuress.

Since Bou and Isaac lived in different cages, they

A handful of *Psammomys obesus*, stocky, rat-sized rodent of the desert.

acquired the habit of climbing to an empty cage between theirs, and each meeting was begun with a faint whistle. Isaac was always full of compliments, while Bou might slap him in the face, run under the shelf or else behave coyly. In happier moments one nibbled the other under the chin, or on the cheek. When one was thus "kissed" the whole body collapsed.

It is a chill morning and Bou would like to return to her nest, but the tickling finger immobilizes her.

The kind of desert country that is the native haunt of the *Psammomys*, which dwells there in pock-marked mounds of pale sand topped by small bushes.

While playing with Isaac I was amazed to see him suddenly stop romping and become immobile. A second before he had frolicked like a kitten, with sudden jumps at my hand, drunken pretensions of biting my fingers, and dashings under his shelf. Back to play again, he had become so wild that he had fallen on his side and scratched my hand with his hind feet as I tickled his belly and covered him with my fingers, moving all over him like a dozen neurotic spiders. Yet now, merely because I had half-consciously touched the magic spot on his cheek, as Bou did, he was immobilized.

"Barbara, come quickly!" She appeared and I said, "Look." To prove how paralyzed he was I wiggled his feet and gently tweaked his whiskers and ears. No response. I tickled his neck and side and he fell over with a faint whistle of resignation. As Barbara bent over for a better look I bared his teeth. He might have been anesthetized in a dentist's chair, although I was ready to yank my hand away in case the patient made a vicious lunge with his incisors.

Thereafter we often tickled his neck and sides, and he always got a foolish, helpless expression while simultaneously stopping whatever he was doing. A moment later he toppled over. If visitors were present we would ask, "Like to see his teeth?" Some horrified visitors blasphemed Isaac with, "Oh, I don't want to see a rat's teeth!" But most were curious. This being Switzerland, where the Alpine marmot, a glorified and somewhat finer-proportioned woodchuck, makes his home, many asked: "Is that a miniature marmot?"

When autumn came Bou and Isaac seemed well satisfied with their new life. As the evenings were chilly they spent more time in their nests. Once Bou was disturbed while sleeping. She awoke suddenly and whirled about ready to bite, and making signs of ardent, scratchy rejection with her little forepaws. In Nature this immediate reaction may save *Psammomys'* life, where instead of two friendly fingers holding a carrot the intruder may be a viper or small carnivore.

Between eating and sleeping, Bou and Isaac devoted many hours to washing themselves, putting their stores in order, and nest-making. Their toilet habits were impeccable and they always used the same corner.

One chill morning I entered the room and quietly went to Isaac's cage, anxious because it had been a cold night and I was afraid I had not given him enough nesting material. Far in the back was a mountainous nest with Isaac squatting in the crater and erupting at intervals, mainly in the form of a hairy arm that came out for some purpose. Looking closely, I saw he had first made a nest of all the softest material available in the cage. This being insufficient, he had taken all his food and added that, making an edible patchwork quilt of bits of apple, carrot, lettuce, bread and boiled potato. Another short doze and a lazy *Psammomys'* arm reached out and casually dragged a lettuce leaf to his mouth, nibbled it, fretfully pushed it away and down went his head for another rest.

FROM OUT OF SIGHT

How must this poplar leaf have danced from night to dawn
With partner wind to reach our far-off bit of lawn!

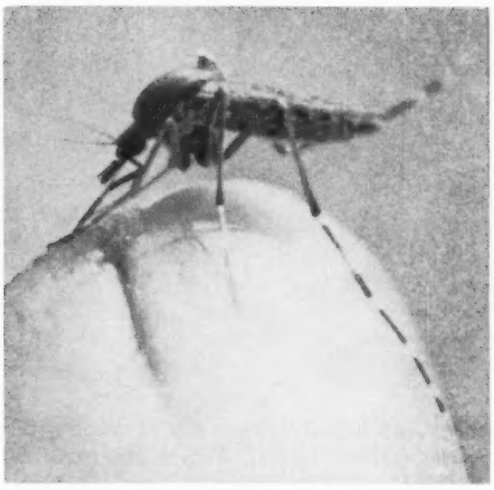
Rachel Graham

Mosquitoes were leading actors in a

Salt-Marsh Episode

By IVAN R. TOMKINS

Photographs by the Author

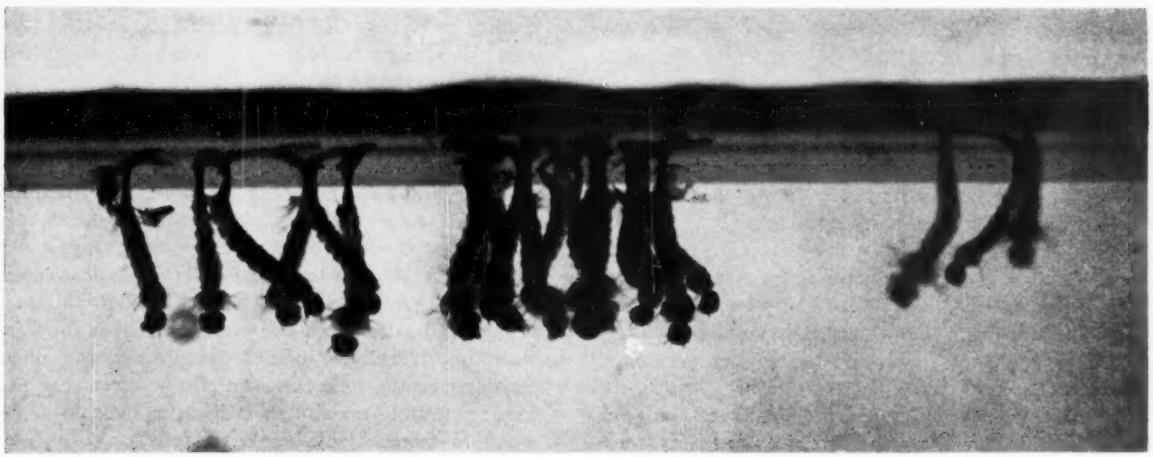


Female mosquito, seeking mammalian blood to ripen her eggs, poses on the author's thumb.

ANYONE who has been much in the salt-marshes of the south Atlantic States has often found immense concentrations of mosquitoes. These are quite out of the ordinary, and known invasions have been reported from communities some miles inland, or, perhaps, from vessels at sea.

One day three of us stopped to camp on an isolated island a few miles inside the barrier islands of the outer coast. It was an island we knew well. It had shell reefs in front, a sandy beach, and its normal population of mosquitoes made no great trouble. On this afternoon, however, the insects literally covered us wherever the breeze was not too strong, or where the sun was not too hot. As night came on, the mosquitoes were everywhere, and they seemed unconcerned about smoke or fire. It took a couple of hours after dark to cook two buckets of crabs. Then the pests became so bad we took to our boat, some time before midnight, and went out a couple of miles across open water to a small, nearly barren sand island. The others went ashore but I stayed in the boat. At about two in the morning they gave up and took refuge on the beach. Nothing seemed to give enough protection, even blankets staked down and the edges covered with sand. So we left for a fishing bank a mile or so out in the open Sound. Even there the mosquitoes rode in on the early morning breeze to pester us. Only the sun and stronger breezes brought us comfort.

After this experience, and noting the great numbers of immature mosquitoes in the salt-marsh pools, some bits of information from entomologist friends helped to supply some reason for the happening. The naturalist



Immature mosquitoes in an aquarium gather at the water surface to breath. Turn this photograph upside down and note the interesting effect.

The mosquitoes in the aquatic stage swarm so thickly about the grass-root edges that they form a dark border.

After they emerge as winged adults, mosquitoes seem to occupy every bit of vegetation as a resting place until they harden up enough to start on the activities of adult life.

should be a logical man and able to reason without too much personal feeling. Viewed thus, our mosquito episode begins to be interesting—even a thing of beauty—and a part of the biotic scene.

The salt-marshes are about as much like they were in primeval times as is any part of this section of country. In many ways they are nearly unspoiled by man. In a small area of these marshes the mosquito hordes breed much as they have done for a long time. This little portion comprises the shallow-water pools that lie at the heads of the salt creeks in the marsh. They are a fundamental part of the area, and are the result of natural forces. Such marsh environs arise from the effect of wind and tide on the marsh mud, the firmer sand and oyster shells. Spring tide and neap tide, storms that cause wave action, salt-water creeks that have mouths on both ends, and many other factors are involved in creating such marsh conditions. If destroyed, there is a tendency for the forces to create others.

These pools remain dry for weeks at times, or until rains or extra high tides fill them. Then they hold water, often also for several weeks.

The females of the salt-marsh mosquito, *Aedes taeniorhyncus*, find these pool areas suited for laying their eggs. Perhaps some saline properties of the place make it acceptable. Farther inland the marshes grade into fresh-water, which is not so suitable. When the water evaporates from these saline pools, the salt remains to redissolve if rainwater fills them instead of the salt tides.

During the time the pools are dry, the mosquitoes lay their eggs on the ground. In this single fact is the main clue to the great number of adults that appear at certain times, for the eggs accumulate, during the dry time, until their number is almost beyond belief.

When rain comes, or when high tides bring an inch or so of water into these pool areas, the mosquito eggs hatch almost at once. The water is soon alive with a mass of wigglers. They concentrate around the edges of the grass clumps, unless disturbed. Then they move out into the open water, only to gather back at the grass roots shortly. I have seen dark masses along the grass line, or dark spots the size of a platter, at a distance of one hundred feet, only to find it composed of an almost solid mass of mosquito larvae and pupae.

When the brief aquatic stages are over, and the winged adults emerge, the discarded pupal cases litter the water like chaff. The newly transformed mosquitoes gather on any nearby vegetation, for perhaps a day, to harden up and get ready for their days, or perhaps one should say their nights, on the wing. While resting in the vicinity every twig and leaf bears all the insects it can hold. From now on is the time when the females are such pests to human beings.

If, after such a "hatch" occurs, there come winds that blow steadily for several days and nights, great quantities of the insects become dispersed for many miles. Probably night winds distribute them more than day winds. If no winds blow, the mosquitoes have only their wings on which to move, hence their range is not far from the place of breeding. If a northeaster comes the inland country is infested with them, but if there is a continued wind from the westward, then they are blown out to sea. We have no thought that any of the pests ever return, unless accidentally by reversal of the wind. Probably most of them live out their days and perish, far from suitable breeding places.

In order that the series of pictures might be complete, one was certainly needed showing an adult mosquito.

Shorebirds of several species arrive to dabble in the mosquito-laden pool and to eat fully of the abundant mosquitoes.

It was a simple matter to "negotiate" with one bloodthirsty individual until it settled on my thumb, then hold it out in front of the camera. Although savoring of a trick shot, it was a simple matter, requiring only a camera with a long bellows and the simplest of technique.

If the hatch of accumulated eggs occurs during the long summer or fall seasons, when the flocks of migrating shorebirds are prone to linger along the beaches and in the marshes, they gather in the pools and dabble here and there, apparently eating the wigglers in great numbers. The smaller sandpipers feed in the shallower water, but the yellowlegs and others of their size feed farther out. They all get so attached to the ponds that they do not readily leave, but just fly around a little and settle again nearby.

The pictures here will never be circulated by any Chamber of Commerce, and I hope they will not give anyone the idea of making mosquitoless marshes. This species does not carry disease to any human being.

It Looked Like Columbine

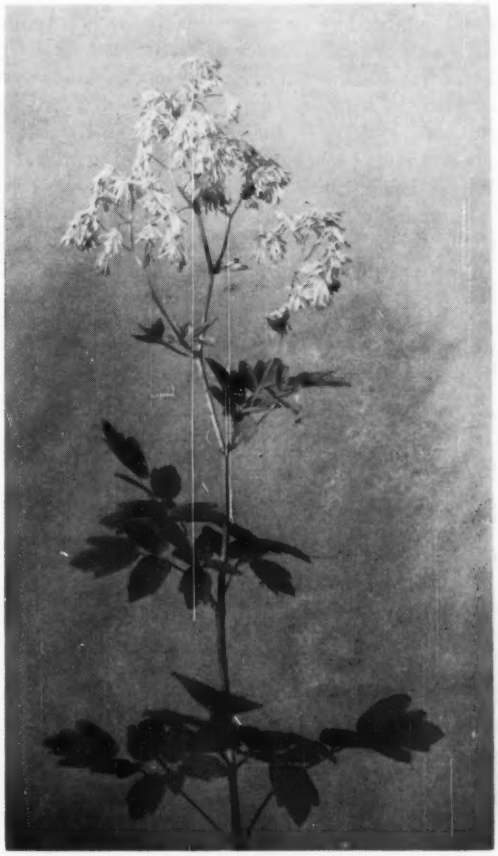
By RALPH J. DONAHUE

Photograph by the Author

Some years ago we were salvaging wild flowers from a rocky, timbered area, soon to be invaded by a cement mill's search for newer sources of limestone. We came to several plants we thought were wild columbine, and promptly dug them up. We set them out in our wild flower garden plot, and watched them grow. The first year still gave us no hint that we were wrong, for no flowers appeared. Next season we saw buds developing on the tip of the purplish stalks. We looked forward to the time when scarlet and gold blooms of columbine would brighten that part of our land.

But something was wrong. Instead of the red and yellow expected, there appeared, in early July, peculiar greenish-white feather tufts from petalless flowers. We promptly made a photograph of the growing plant, and sent a print to the Botany Department at the University of Kansas. There Professor Roland L. McGregor introduced us to the purple meadow rue, *Thalictrum dasycarpum*.

Our meadow rue plants grew to a height of three feet, but we found that an eastern relative climbs much higher. The purple species thrives, we learn, in moist meadows and thickets from Ontario, south through Ohio, Illinois, Indiana, Kansas, New Mexico and into Arizona. It belongs to the Crowfoot Family, to which also belong the columbines, anemones, wild larkspur and monkshood. Says Professor McGregor, "although meadow rue is a nice plant, it is often overlooked."



Purple meadow rue, *Thalictrum dasycarpum*, blooms from late May to July.

An Upside-down Nest

By NORMAN S. EDSON

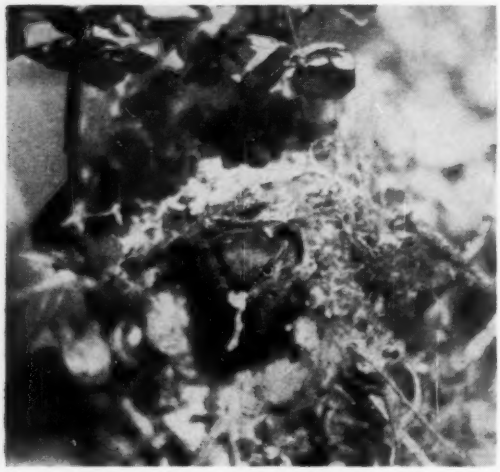
Photographs by the Author.

Bush-tits, as everybody knows, build their pendant nests from the top downwards. But I witnessed a pair with revolutionary ideas. They built from the bottom up.

Right below my living room window I watched them from the day they started to anchor their nest to the dried stalks of an old, dead hydrangea bush. A stunt like this was too good for a bird photographer to pass up, so I set my Speed Graphic camera on a tripod, and took shots from time to time as the work progressed.

Bush-tits are not much bigger than your thumb. Mouse-colored on the back and lighter underneath, they have bright, beady eyes and long tails, and are as quick and snappy as chickadees. It was wonderful to see one of them arrive with a shred of tree moss in its beak, followed by its mate with a wisp of cobweb to be used as a binder. Then, with deft, sure strokes, they wove round and round, much as mother knit my socks.

When the nest was slightly higher than a teacup, Mrs. Bush-tit hopped in. Pressing herself to the bottom of what was to be her bedroom, she began bumping the sides with her breast. I have seen robins do likewise in their mud-lined nests. Suddenly rising stiff-legged, she threw herself violently back and forth as though bent on wrecking the whole works. At last a weak spot developed and she nearly fell outdoors. Calling her mate, they went to work with more moss, and bits of stringy weed, and darned the hole as good as new. This stunt of "bump and break and mend again," was repeated until the nest was some twelve inches high. Then the top was roofed over and a small, round hole left beneath the eaves for an entrance.



The bush-tit cleans house.

The bush-tit beside its upside-down nest in the hydrangea bush.

Now came the job of lining the bottom of the nest with plant-down in preparation for the five to eight eggs the female would be laying. Thinking to help her out, I hung a tuft of medicated cotton on a twig close to the entrance. She would have none of it, turning up her beak at modern sanitation, preferring the same material her mother always used. Then followed the egg-laying period of about fourteen days, during which time I seldom caught sight of either one. I knew where she was, but her husband I saw no more.

When the babies hatched I was away, so I never saw my upside-down bush-tits any more.

Psaltriparus minimus, as a species, ranges from British Columbia and western Wyoming to western Texas and Baja California. My upside down bush-tits I photographed on Vashon Island on Puget Sound, Washington. In February, March and April I have watched them in flocks of hundreds as they worked over deciduous twigs for insects, keeping track of each other with soft calls. Except for their extreme activity they would never have been noticed.

Smokey, Junior, thrived on a bottle, pablum and public attention.

Smokey, Junior

By PEYTON MONCURE

Photographs by the Author.

Most Americans have heard of Smokey, the U.S. Forest Service bear, who was first found in life as a cub in the wake of a forest fire, his small paws scorched and blistered from running aimlessly about in the smoking embers. He has grown up now, and has become a popular symbol in the campaign to save our forests from the ravages of fire.

But how many people have heard of Smokey Bear, Junior? His—or, I should say, her—advent into the world of man, although perhaps not so poignant and dramatic as that of her predecessor, was nevertheless unusual. And the way in which Smokey, Jr., came to us here at the Forest Service in Missoula, Montana, was quite impromptu and unannounced, especially for her.

Smokey, Jr., was jolted into the cold world early in the spring of 1955. A road crew was bulldozing logs and underbrush in the Swan River Valley near Missoula. The den in which the cub and her mother were hibernating happened to be in the way of the bulldozer, and the machine accidently rooted mother and youngster out into the snow. The mother bear took off in flight, leaving the two-week-old baby wriggling in the snow. The men returned the youngster to what was left of the den in hope that its mother would return to it. Evidently, however, she had been thoroughly frightened, for she never returned to her maternal responsibilities.

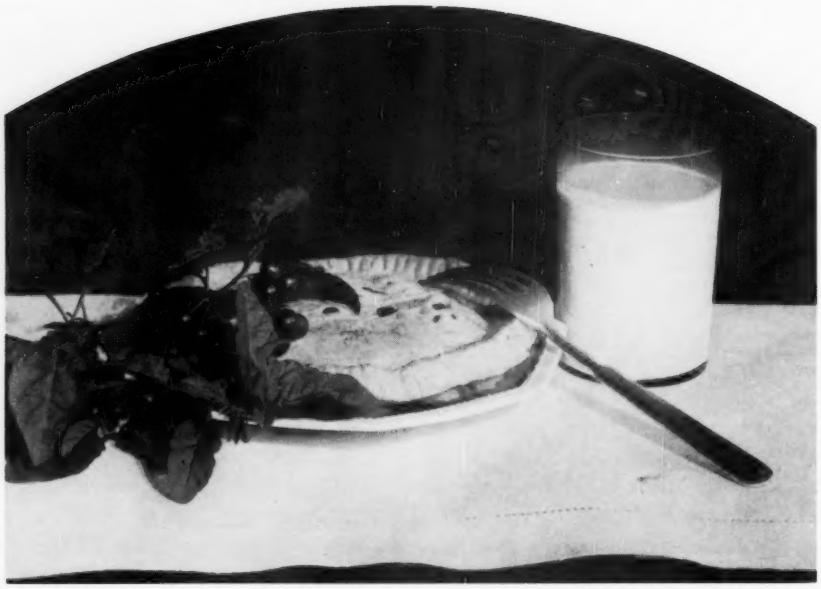
So Smokey, Jr., was taken home by State game warden Clyde Howard. There she became the pampered darling of the warden and his wife, who raised the cub on a nursing bottle.

At the age of seven weeks Smokey Jr. really became the center of attention. Montana Conservation Week is sponsored by the Montana Conservation Council, and with the cooperation of the State Forester's office, the State Fish and Game Department, and the U. S. Forest Service. For this observance the cub was taken to Region One Forest Service Headquarters building in Missoula. There she became the center of attraction for more than 7000 adults and children who came to see her, touch her, and even hold her.

Later, Smokey, Jr.'s fan mail began coming in. Letters beginning "Dear Smokey," or "Dear Forest Service and Smokey," or similar salutation, came from youngsters, most of whom had joined the Smokey Bear Junior Forest Rangers while at the exhibit. All expressed their love for the playful cub and their thanks for being invited to visit her.

Smokey, Jr., was kept in a chicken-wire pen while at the Forest Service building. She was fed a bottle of milk and honey every four hours. At night she was taken home by Mr. Howard and enjoyed a dish of pablum for supper and another for breakfast.

Officials at the week-long exhibit were much impressed by something else besides the host of Smokey Jr.'s fans, and that was the well-mannered conduct of the hosts of school children who visited the cub and the rest of the forestry exhibits. Not a gum wrapper was dropped; not a prank was pulled. According to forestry officials, teachers and parents had great reason to be proud of their youngsters. There (*continued on page 276*)



A pie made from black nightshade is no more poisonous than the glass of milk beside it.

Nightshade Pies and Murder

By GILEAN DOUGLAS

THE OTHER day I picked up a "whodunit" in which the villian's poison weapon were the berries of *Solanum nigrum*, or black nightshade. That gave me a worse shock than the fictional crime itself. For years I had made pies, jam and jelly out of black nightshade berries, and I am still definitely alive.

Solanum nigrum has green stems, modest white flowers in clusters, and drooping black berries. It is common on this continent, blooming from June to August in fields and on stream banks. I have seen it from a bush a foot in height to one of five feet, or a bit more.

There are more than nine-hundred members in the *Solonaceae* family, to which it belongs, and the largest number of these grow in tropical America. Some are used for medicine, several are cultivated for ornament, others are troublesome weeds (horse nettles, for example) and some—like the potato and tomato—give us good foods.

The sand burr is also known as the beaked nightshade; the bindweed or bittersweet as enchanter's or woody nightshade. Plants of a different genus, but which resemble the nightshade, have been given its common name. Pokeweed, for instance, is also called American nightshade, and in some places any species of trillium is known as three-leaved nightshade. In India, Malabar nightshade, *Basella rubra*, is used as a pot herb.

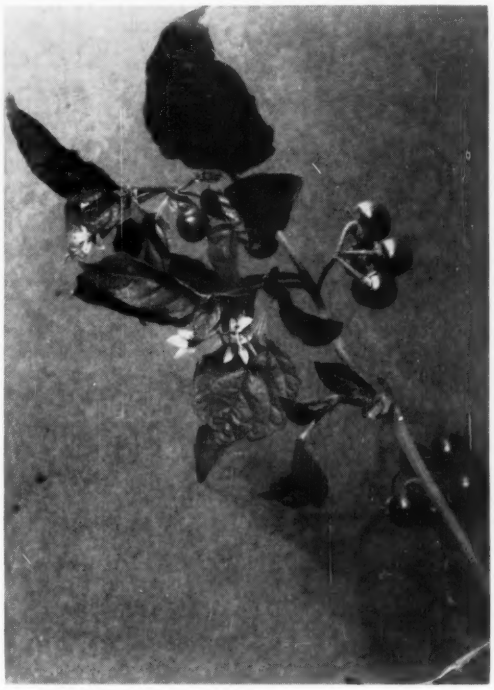
Solanum comes from the Latin *solamen*, meaning quietening, narcotic, and this applies to a number of members of the nightshade clan in varying degrees. But the real black sheep of the family is *Atropa belladonna*, or the lethal deadly nightshade—the plant that the whodunit author confused with my pie filling. It is well known in southern Europe and western Asia, but decidedly not on this continent. I have never come across it here in a wild state, although I will not say it has not become a garden escape. Atropus, by the way, was one of the Greek Fates, and the fate that comes to those who eat many of the drooping black berries of the *Atropa belladonna* is death.

Deadly nightshade contains the alkaloid atropin, which can cause confusion of mind, stupor and death. From it comes atropine, used beneficially in medicine. The poisoning symptoms mentioned were among those described by the murder mystery author, but wrongly attributed to black nightshade. The two plants look very much alike and many intelligent people believe them to be the same, or else equally dangerous.

That is what happens when a family gets a bad reputation. Prior to 1830 even the tomato—called "love apple" then—was reputed to be poisonous, although the Fiji Islanders could have corrected that idea. When they were still cannibals—which was not so long ago, at that—they used to eat the red fruit of cannibal's tomato, *Solanum anthropophagorum*, along with human

flesh, a macabre menu of meat dish and salad.

Black nightshade grew all around me when I lived in the Cascade Mountains of Oregon and British Columbia. In season I made pies from its black fruit at least once a week, and, although I will admit that the present condition of the world causes me considerable confusion of mind, those nightshade pies never did. Nor did they kill off my trusting guests, or even reduce them to a stuporous state. As this went on for some seven years I think it might be called a fair test, especially as I also ate the stems and leaves of this plant as a vegetable. According to the U. S. Dispensary, "the leaves are said to be consumed in large quantities in the Isles of France and Bourbon, as in the Hawaiian Islands."



Black nightshade has green stems, modest white, clustered flowers and drooping black berries.

In the Dakotas, Nebraska, Oklahoma and parts of Texas the black nightshade is cultivated and used widely as fruit, under the names of blueberry and stubbleberry. The Indians of the Pacific coast, from California to Alaska, ate the black nightshade berries mixed with salmon oil. For winter storage they dried the fruit and pressed it into cakes. But, at the same time, these same Indians thought that both the red elderberry and the red huckleberry were poisonous. "Whenever they (red huckleberries) were eaten the reason of that person would probably disappear and he would attempt to go (wander) in the woods." There are people today who will tell you that the red elderberry causes illness and even death. When I heard this in the mountains my reply was to open my roothouse doors and point to the jars of red elderberry jam and jelly (lemon or orange peel adds flavor and pectin) sitting inside on the preserve shelves.

Whether they have eaten nightshade berries or not, many others besides whodunit writers are confused on this subject. There is more excuse for this in Europe, where both the black and deadly varieties grow wild in many places. The former was supposed to have been an import from the Continent to the Pacific coast, but it is on record that Dr. John Scuder found it growing wild in Oregon in 1825.

It is too bad that this innocent and attractive plant should have acquired such a bad name. Just another victim of uninformed gossip. Anyone in real life who tries murder or suicide by black nightshade berries will have a surprise coming to them. If you do not believe me, I am more than willing to be a guinea pig.

P. S. I prefer my *Solanum nigrum* berries in pies. But if you are not a good cook I will take them raw, because a good pie depends so vastly on the skill of its creator.

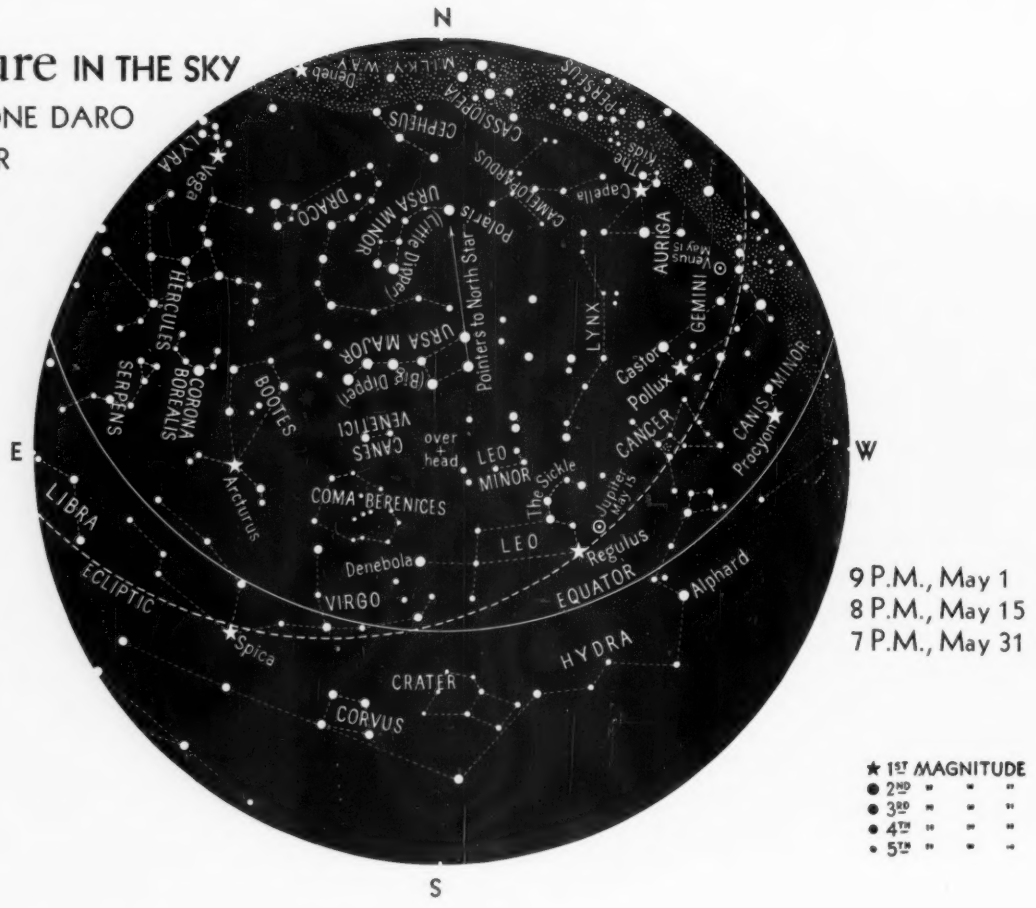
ABANDONED FARM

There is no entrance. The vines have laced it shut.
Yet the forest, unleashed, advances over the meadows,
And narrow deer paths, neat diagonals, cut
Through lily beds to widening leaf shadows.
Clashing his cymbaled cry, the pheasant rustles
Through standing, straw-stalked grass; while bumble bees
Unpack themselves from winter sleep, flex muscles,
And pollinate the plumes of plum and pear trees.
Ivy tugs at the stones of the house and forms
A canopy for a woodchuck hole. A rabbit
Nests near the leaning barn weakened by storms
And riddled rafters that chewing termites inhabit.
The diligent weeds cover a boot, a comb.
For nature owns this place. It is no man's home.

Joan Lascelles-Ranson

Nature IN THE SKY

By SIMONE DARO GOSSNER



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. Times given are for Local Standard Time.

Sunspots

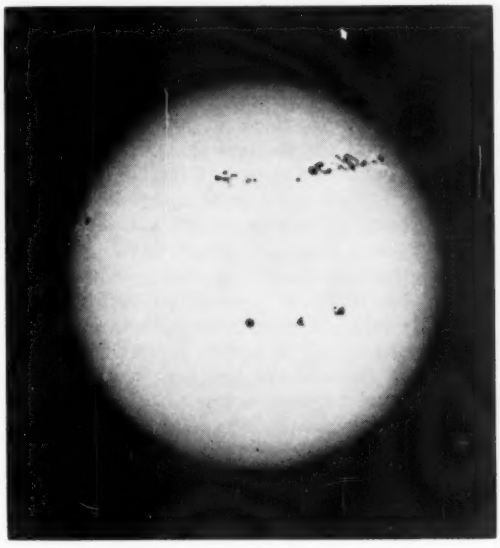
In the middle of last February a group of spots formed on the surface of the sun and reached such proportions that they rapidly became visible to the naked eye. Such an occurrence is by no means rare, but, because of the intense brightness of the sun, it is apt to remain undetected by the layman. Astronomers who have access to daily photographic records know, of course, when sunspots are present, and they can judge whether these are big enough to be visible to the unaided eye. Others, unfortunately, must rely on pure luck and favorable circumstances.

The best time for an amateur to look for spots is shortly after sunrise, when the morning haze cuts out the glare, or at sunset, or at any time when a light fog is present. At all other times it is advisable to protect one's eyes with heavily smoked glass, or the equivalent, if one intends to look directly at the sun. Ordinary sunglasses are not adequate. *Under no circumstances* should one ever observe the sun directly through opera glasses, binoculars, or, least of all, through a telescope. Focusing of sunlight on the retina may cause permanent eye damage, or even blindness, just as surely as focusing the sun's rays on a dried leaf with a magnifying glass will cause it to catch fire. For similar reasons, the use of dark filters with the telescope is not recommended, as the extreme heat may shatter them.

The proper procedure, followed at observatories everywhere, is to pull out the eyepiece of the telescope an inch or so beyond its normal focus position. By holding a piece of white cardboard about two feet from the eyepiece, it is then possible to project an enlarged image of the sun on this improvised screen. If any

sunspots happen to be present, they will appear on the screen. The observer may, if he so chooses, draw the spots directly on the white cardboard by merely following the outline of the projected image, or he may photograph the image itself. This procedure for visual observation of sunspots has been in constant use, with few modifications, since the time of Galileo and Father Scheiner, both of whom started using it at the beginning of the seventeenth century.

Large sunspot groups are expected surely to occur with increasing frequency for at least another year, and perhaps well into 1958. This is because we are approaching a period of maximum solar activity. It is not possible to predict accurately when this maximum will take place. Our knowledge of the so-called *sunspot cycle* is imperfect. Statistics based on observations of the past two hundred years indicate its presence, but its causes are still unknown. The average length of the cycle, from one minimum to the next minimum, or from one maximum to the next maximum, is slightly more than eleven years, with sensible variations from one cycle to the next.



OFFICIAL U. S. NAVY PHOTOGRAPH

The sun on February 25, 1956.

The past few cycles have been somewhat shorter than average. The last one, from the minimum of March, 1944, to that of April, 1954, lasted a bit more than ten years. This was the fourth consecutive cycle of less than ten and one-half years. It has been noted, although the reason is unknown, that a fast rise to maximum is followed by a much slower decrease in activity than in the case where the maximum is reached more leisurely. The rise that we are witnessing at the present time gives every indication that it will be short and intense.

In order to provide a means of locating the position of spots on the solar surface, a system of latitudes and longitudes has been devised. It is essentially comparable to latitudes and longitudes on the earth. The sun is known to rotate on an axis the orientation of which is known for every day of the year. Calling this the polar axis, we know where the equator lies. Latitudes are counted north and south of the equator, while longitudes are counted east and west of the central meridian.

At the beginning of a cycle, shortly after minimum, spots begin to appear at latitudes averaging 30 N and S. As the cycle progresses, the spots descend gradually toward the equator. Their latitude averages 15 N and S at maximum, and the last spots of the cycle, near minimum, appear at about 8 N and S. There often is a slight overlap between the old cycle and the new one, the new spots appearing once again at higher latitudes, while the old ones appear close to the equator.

Sunspots partake in the sun's rotation. After a fairly large group has moved across the disk and finally disappeared at the western edge, we may expect to see it reappear at the eastern edge after a lapse of fourteen days, unless it has been dissipated in the meantime. Many groups are known to have lasted for five or more consecutive rotations of the sun.

When a large group appears, it is often accompanied by magnetic and ionospheric disturbances on the earth. Familiar manifestations of these disturbances are the occurrence of intense northern lights (aurora borealis), magnetic storms, and severe disruption of radio communications (black-outs). The forthcoming sunspot maximum is the first one to take place since television became a household word. We shall have to brace ourselves against periodic difficulties in telecasting as well, since TV-waves differ from radio-waves only in their frequency. Recent advances in the field of radio propagation have made it possible to use sunspot observations to forecast the frequencies at which radio fade-outs will occur. Such forecasts are of primary importance to military and civilian communications. Advance knowledge of the unusable frequencies enables one to switch over to the unaffected portion of the broadcast band.

In the past, and even today, man's imagination has tended to run wild when it comes to interpret the terrestrial influence of sunspots. They have been blamed for everything from economic depressions to world wars. These claims are entirely unsubstantiated and border on the ridiculous. The only proved influence is that on geomagnetic and ionospheric phenomena.

What are sunspots, really? Believe it or not, they are extremely bright, in spite of the fact that they appear black to us. They look dark only by contrast with the much hotter surrounding area. Their average temperature is of the order of 7500 to 8000 degrees Fahrenheit, against 11,300 for the sun's surface. Spectroscopic observations have revealed that they are gigantic whirlpools that tunnel into the sun's interior. They are often, but not always, associated with prominences and bright flares.

In order to be visible to the naked eye, the spot must be at least fifteen to twenty thou- (*continued on page 276*)

Nature IN THE SCHOOL

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

Minnows in Schools

OBVIOUSLY THE TITLE OF THIS month's school page could have at least two correct interpretations. An aggregation of minnows swimming about together is, of course, called a school of minnows. It is not to these we refer, but rather to the place that minnows may find in the educational system if they are kept alive and active in a school room.

If we do not consider the children themselves, or the everpresent flies that are to be found where human beings may congregate, it is probable that more schools have minnows in them than is true of any other live animals. Of course, these are for the most part common goldfish, but goldfish are technically minnows.

Few animals exceed goldfish and other common aquarium fishes as aids in teaching something of the physiology of animals. We can watch easily the respiration of fishes, since the movements of the water over their gills is accompanied by movements of the gill covers. The frequency of these movements may be changed by conditions that we may create. An aquarium on a window sill may, through the movement of the sun, be affected by the temperature rising. With the change there is an observable change in the behavior of the fishes. If the fishes are stimulated to unusual activity, this may again be reflected in observable changes in the respiratory movements.

Change in behavior

Almost any considerable change in the physical environment may be reflected in the changed behavior of a goldfish. If we broaden our study to include other minnows, we will find how unwise it is to make a generalization that can be applied widely to all fishes. Some common minnows, like horned dace and common shiner, may be able to survive in the ordinary aquarium for some time, but this is not true of many other kinds of minnows. A brief review of the tables in this month's insert will suggest some kinds that may become good aquarium fishes, or, if it is desired, the children may find out by direct observation which kinds of local minnows make good aquarium species. The chances are good that good aquarium species may lend themselves well to the conditions to be found in artificial breeding ponds. Elaboration of this study might well lead to an understanding of management practices that are involved with other renewable resources than minnows.

Our study of minnows in the classroom should help get over the idea that apparently insignificant organisms may, on the other hand, be possibly the most significant links in a food chain. Without minnows most of the larger species of game fishes would be unable to survive.

Of course, the minnows give us some excellent examples of the dangers associated with the introduction of exotic species into local waters. Carp have ruined many a body of fine fishing water through destruction of the nests of local fishes, through competition for food supply, and through other means. Similar lessons are to be found among the birds, with the introduction of English sparrows and starlings; among the mammals with the introduction of Norway rats; among the insects with the introduction of the Japanese beetle; among the fungi with the introduction of the chestnut blight, and among other plants with examples too numerous to mention here.

Geography of minnows

Studies along this line in school will easily lead to studies in geography, and in the second section of the charts teachers will find information useful in understanding where our minnows are to be found and from what parts of the world some of them have been introduced. All of this should be grist to the geography teacher.

Other inserts than the current number may be consulted if more information is needed. Among the earlier inserts useful in understanding minnows and associated living things may well be the following: #1, Aquatic Insects. #5, Food and Game Fishes. # 50, Beetles. #56, Pond-surface Plants. #59, Mollusks. #60, On the Level. #69, Fresh-water Algae. #70, Aquatic Insects. #72, Bugs. #79, Aquarium Fishes, and #82, Pond Weeds. These, of course, refer to the life to be found in fresh waters. Other inserts have considered marine life as well, but few, if any, minnows enter even brackish water and survive. The present insert suggests that one may be able to do this. Which one is it?

If one is teaching older youngsters who may be interested in animal anatomy some significant lessons may be found by opening the bodies of some of our common minnows that may have died of common causes. Notice how great the variations may be in the length and position of the intestinal tracts of minnows available for observation. The animal-eaters as a rule, have shorter and straighter intestinal tracts than do the plant-eaters, or the so-called mud-eaters. Possibly you or your pupils may find in logic an explanation for this situation. It is relatively simple and most interesting.

Propagation of minnows

It should be suggested that every school will find it worth while to get the U. S. Fish and Wildlife Service Circular #12 dealing with the propagation of minnows and other bait species. I am willing to wager that such a booklet, placed where the average boy may get his hands on it, will find rugged use. It may even be reflected in action that may help some youngsters financially. It might be pointed out that in some States it may be necessary to get a license to rear minnows, but this should only add interest to our topic and might lead to a proper approach to our law enforcement agencies. This might lead to inquiries about how other bait organisms may be reared under controlled conditions. If such activities do not represent real dynamic biology, then I am willing to surrender to the more orthodox reading of a dry textbook by those who lack the imagination to see the possibilities here.

Of course, there is an abundant and a fine literature about fishes and fishing, and much of this concerns itself with minnows, the subject of our current insert. Writers such as Van Dyke, Walton, Dalrymple and others may well have books on the school library shelves that could be taken down and used a bit in a school room where minnows were really used as teaching devices.

Some may care to make some study of the common names of some of our minnows to determine to what extent they are appropriate descriptions of the animals. Many of these names, such as horned, horny-headed, fathead, brassy and blacknose, obviously refer to the appearance of the fishes. Others like creek, river and lake describe the place where the fish are to be found. Still others like stoneroller refer to the habits of the fish. Some English teachers may object to the use of blacknose instead of blacknosed, longnose and spottail instead of longnosed and spottailed, but it happens that the American Fisheries Society has a committee on such matters and they seem to prefer what to me is the poorer English. With that we will leave the discussion up in the air.

Just what do we mean, piscatorially, by a minnow. Technically it is a fish belonging to the Family Cyprinidae. There are considerably more than a thousand species of fish belonging to more than 200 genera to be found in the fresh waters of North America and the Old World, and more than 200 of these species are to be found in the United States. Generally, these fishes are without teeth on their jaws. For the most part the fins are without spines. Usually there is a large, two-compartment, air bladder, and while the head is usually naked the body is almost invariably covered with relatively smooth scales. We include in our treatment here the carp and the goldfish, both of which have their origin in Asia.

If we accepted as minnows many fishes that are popularly known as minnows we would have to include many not belonging to the Family Cyprinidae. Conspicuous among these might be the mud minnow, top minnows and a few others, many of which are relatively closely related to the pikes and pickerel.

It is always well to suggest references that may supplement the information given in these inserts. Some that will be found most useful in learning more about minnows follow:

Beckman, W. C., *Guide to the Fishes of Colorado*, Leaflet No. 11, University of Colorado Museum, Boulder, Colorado. 1952. 110 pages.

Carlander, K. D., *Handbook of Freshwater Fishing Biology*. W. C. Brown Company, Dubuque, Iowa. 1953. 428 pages.

Carpenter, R. G. and H. P. Siegler, *Fishes of New Hampshire*. New Hampshire Fish and Game Commission. 1947. 87 pages.

Dobie, J. R. and O. L. Meehean and G. N. Washburn. *Propagation of Minnows and Other Bait Species*. Circular No. 12, United States Fish and Wildlife Service, Washington, D. C. 1948. 113 pages.

Dalrymple, Byron W. *Panfish*. McGraw-Hill Book Company, New York City. 1947. 398 pages.

Eddy, Samuel and Thaddeus Surber. *Northern Fishes*. University of Minnesota Press, Minneapolis, Minnesota. 1943. 252 pages.

Harlan, James R. and Everett B. Speaker. *Iowa Fish and Fishing*. Iowa State Conservation Commission, Des, Moines, Iowa. 1951. 237 pages.

Hubbs, Carl and Karl F. Lagler, *Fishes of the Great Lakes Region*. Cranbook Institute of Science, Bloomfield Hills, Michigan. Bulletin 26. 1947. 186 pages.

Legendre, Vianney, *Key to Game Fishes of the Province of Quebec*. Game and Fisheries Department, Montreal, Quebec. 1954. 180 pages.

McClane, A. J., *The Wise Fisherman*. Wm. H. Wise and Company, New York City. 1952. 1336 pages.

Pratt, H. S., *Manual of the Vertebrates of the United States Exclusive of the Birds*. P. Blakiston's Sons. Philadelphia, Pa., 1923. 422 pages.

Walton, Izaak, *The Compleate Angler*. Reprint of 5th Edition published in 1676. E. P. Dutton. New York City. 215 pages.

Footprints

There is a special charm to entering the Children's Room of the Montclair, New Jersey, Public Library. Stepping stones that approach the entrance bear the tracks of raccoon, meadow mouse, rabbit, deer, bear, skunk, heron and yellow-legs, child and dog, imprints of several plants and one mystery print. These were cast in concrete by Mrs. Robert A. Arny from prints taken from mud or snow in her local garden or in Montclair parks.

THE Nature CAMERA

By EDNA HOFFMAN EVANS

This is a picture of the moon, somewhat out of focus, taken through a 45-power telescope

The Skies on Film

PHOTOGRAPHY CAN BE MANY THINGS to many people. That is one of the most fascinating aspects of it as a hobby. Not everyone "sees" pictures in the same things, but, on the other hand, there is scarcely anything that the human eye can record (or the human mechanism experience, for that matter,) that does not strike someone as being a good subject for a photograph.

Sometimes the things we look at oftenest are the things we "see" the least, so far as picture taking is concerned. My own case is one in point. I divide the major portion of my year between two regions famous for the beauty of their night skies. Thus, with the star-studded firmament over my head each night, I have not for a long time tried to capture it on film. I am acutely aware of the planets, the moon, and the stars, of course. But, somehow, Arizona and Florida night skies seem too breathtakingly magnificent to imprison on film or pen up in the confines of a photograph.

I wish sometimes that it would be possible to take color pictures of the skies I am familiar with. That way I might be able to decide which is more wonderful—the clear, dry brilliance of a night sky over the southwestern desert, or the moist, languorous beauty of the stars that shine over the Gulf of Mexico. They are the same stars, but somehow or other they do look different. But then I would have to capture the feel of the desert wind, the warmth of the rocks long after sunset, the sound of the waves against the beach, and the smell of the fresh salt air.

Astronomical photography

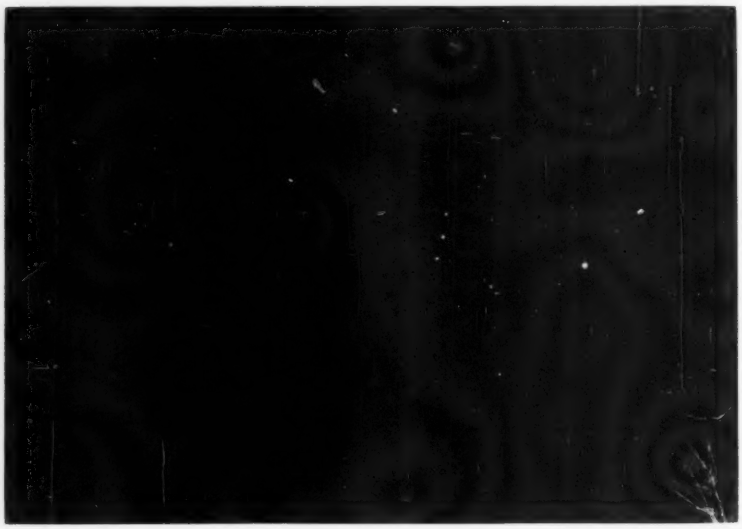
Be that as it may, it has been several years since I wrote about night time, astronomical photography. I had not been conscious of this lapse until a letter arrived recently from Jackson L. Boughner of Palatine, Illinois.

"The last reference to star photography with a simple camera," his letter began, "appears in your August-September issue of 1953." And so it did. At that time I described the recording of star trails on film by leaving the camera lens open for several hours per exposure and aimed at the region of the North Star. The circular patterns that result from this technique seem to me to be particularly interesting.

It has not been so many years ago that star trail pictures were about the only ones that an amateur photographer—minus telescope and other astronomical equipment—could take successfully. The surprisingly fast movements of the stars (or rather of the Earth as it rotates on its axis) caused the stars to appear as streaks of light on the photographic negative when time exposures were made of them. And time exposures were the only kind possible because of the "slow speed," or lack of sensitivity of the usual photographic film.

In the last couple of years, with the development of much faster, more light-sensitive film, this picture has changed, literally. A film speed exposure index of 100 was tops until recently; now speed indexes of 200 or better are the order of the day. Mr. Boughner pointed this out in his letter. "While the pictures by no means compare with those taken through expensive telescopes with clock mechanisms, I thought you might be interested in what can be done with the new, fast films."

His letter continued: "I recently decided to apply 'available light' techniques to star photography. The pictures were taken with an Edixa camera at f 2.8, using no auxiliary lens, on Tri-X film. They were developed in Microdol for thirty minutes, and each picture was enlarged seven times." Tri-X film in rolls and packs has a daylight exposure index of 200, and the term "daylight" means that no artificial light is used.



Orion, the hunter, whose beauty dominates the winter sky at night, appeared thus after a 10-second exposure made by Mr. Jackson L. Boughner of Palatine, Illinois.

This picture, in which Ursa Major is the dominating constellation (see it dipper up with the handle slanting toward the left), was taken at a sixty-second exposure.

As to the exposure time Mr. Boughner found most satisfactory, here are his findings. "Orion was taken at a ten-second exposure, Taurus at thirty seconds, and Ursa Major at sixty. The ten-second exposure comes closest to approximating what is seen by the naked eye.

Winter sky pictures

"I now have photographs of most of the winter sky, taken at ten-seconds," Mr. Boughner's letter continued. "I have spent several interesting evenings orienting my pictures with the star charts in *A Beginner's Star Book*. Then I refer to the star catalogue in the same book to see if I can see any of the double stars, clusters, or other astronomical phenomena described there. It is a very comfortable way of star gazing."

The fainter constellations are recorded much more clearly by the thirty and sixty-second exposures, Mr. Boughner discovered by comparing his pictures. He found that while the constellation Lepus, the Hare, in which there are no stars brighter than third magnitude, appeared only faintly on his ten-second picture of Canis Major, it appeared very clearly on his thirty-second exposure.

"It would be interesting," he speculated, "to know how far down the scale of magnitudes the longer exposures extend. Conceivably, Uranus, Neptune, and possibly asteroids might be visible. A series of pictures of the Zodiac constellations, taken at weekly intervals might show the movements of the asteroids so that they could be identified."

The Illinois star-gazer has not confined himself to stars exclusively, or to pictures taken by the unaided camera. He has also turned his lens on the moon, via telescope.

"The picture of the moon," he wrote, "was taken through a $15, 45-power telescope by simply sighting the telescope on the moon, holding the camera to the eyepiece, and snapping the picture at 1/25 second. It is obviously not in complete focus, but it shows more detail than I anticipated. It was developed the same as the star pictures and was enlarged seven times."

With an eye to the future, he concluded his letter thus: "I have constructed a crude mounting for the camera on my telescope, and when the weather warms up a little I hope to be able to focus the moon properly on groundglass and try again. Perhaps I will have a little success with the planets and a star cluster or two, but a great deal more of experimenting is in order."

Yes, but experimenting and noting the results is one of the major joys of hobby photography. And as the summer months roll on, I hope there will be at least one camera in Illinois pointed skyward at night at such glorious star groups as Cygnus, Lyra, Hercules, and Corona, and especially at my favorite summer constellation, Scorpio—if it is visible that far north.

Fast Film

Coming down from the sky now, but staying on the related subject of new photographic developments and faster film speeds, here are some of the most recent to be reported.

The Du Pont Photo Products Department announces that a new, fast, extremely wide latitude photographic film—SX Pan—is now available in 35mm, 70mm, 1-13/16-inch and 2 1/16-inch widths (100-1000-foot lengths) and in other professional roll film sizes. This new film has exposure indexes set conservatively at 300 daylight and 260 tungsten. The film has a fine-grain, panchromatic emulsion with high red sensitivity, long tonal gradation, and a retouchable surface.

According to the announcement, the wide exposure-development latitude of SX Pan permits its exposure at effective film speeds much higher than the rated indexes. Good results are obtainable, it is reported, at effective speeds of 1/1000 second and more by processing the film in Du Pont 6-D (a fine-grain developer similar to D-76) for approximately twelve minutes at 75 degrees F. Normal development time for SX Pan is eight minutes in 6-D at 68 degrees.

The new film, the company reports, is expected to be of particular interest to photographers who have to make pictures or process them under a variety of conditions, "existing light" cameramen in particular.

Eastman also released a new film—Kodak Royal Ortho Sheet Film—on March 1. This film has a daylight index of 200 and a tungsten of 125. It should be processed for the same times and temperatures as Royal Pan sheet film.

It is expected, according to advance reports, that this film will be of considerable value to press, commercial, and industrial photographers whose work will profit by a fine sheet film with orthochromatic sensitivity. Tests have showed that it gives good results in portraiture, press, and general industrial photography.

Both of the above-mentioned films should be useful to amateur astronomical photographers.

Super-XX film

Owing to some confusion about the availability of Super-XX film, Eastman has released the following clarification. It is only the roll films in Super-XX that have been discontinued. Super-double is still available in sheet film form, in sizes from 2-1/4 x 3-1/4 inches up to 11 x 14 inches. Exposure indexes for this long-time favorite are daylight 125 and tungsten 80.

As for handling film more efficiently during the processing period, there is now for sale a new Kodak Flexo Film Clip at a retail price of thirty-five cents each. It is available at all Kodak stores. The clip is made of stainless steel, with a one-piece construction that makes for easy opening and fast draining. It grips the film firmly without preforating it, has a short bite to prevent intrusion into the picture area, and a wide spread when open for easy insertion of the film.

Some home movie makers, I am sure, will want to acquire the revised booklet on the handling, repair, and storage of 16mm and 8mm films. All too often, it seems to me, prized movie films are torn, scratched, or otherwise marred because of poor handling or bad storage. And once damaged, they cannot be replaced.

The 12-page booklet deals with both black-and-white and color films. It is punched to fit the Kodak Photographic Notebook, and can be obtained without charge from the Sales Service Division, Eastman Kodak Company, 343 State Street, Rochester 4, N. Y.

Science Course

A special course on "Recent Developments in Physical Science," with a correlated course on "The Teaching of Science," will again be offered for secondary-school science teachers by the Harvard Summer School and Graduate School of Education. Twenty duPont fellowships of $400 are available for these courses, which will last from July 2 to August 15 and will each carry four units of graduate-level credit. The courses are open to any interested and qualified teachers, whether or not they receive one of the fellowships.

In addition to these courses for secondary-school teachers, there will be a course on "Science in the Elementary School" for teachers and supervisors on the elementary level. Also of interest to teachers will be a number of other courses in the sciences including astronomy, biology, chemistry, physics, and mathematics.

Teachers interested in applying for one of the fellowships may obtain an application blank from the Harvard Summer School, 2-N Weld Hall, Cambridge 38, Massachusetts.

How Old?

"How Old Is Old?" is the title that Miss Vieno Johnson, 327 West 83rd Street, S-3c, New York 24, New York, has tentatively given to a book that she is writing. She asked us to give her "the names of older people in the nature field who have made satisfying lives for themselves in the later years; people who have triumphed by hard work and good tone—mostly of the mind and spirit." It was difficult to supply such a list, yet we know that there are many among the members of the American Nature Association and readers of *Nature Magazine* who can enrich Miss Johnson's already considerable data. She herself graduated from nursing school and then, 12 years later, took College Board examinations, entered Radcliffe College and was graduated in 1945, thus equipping herself for the added years of life that modern medicine makes possible. Now she wants to help others to anticipate those years and to hear from people who have themselves enjoyed them, triumphantly.

Conservation Awards

Recognizing outstanding service to the National Park Service in the field of conservation, the Department of the Interior Conservation Service Award has been given to Walt Disney, Laurence S. Rockefeller, David E. Finley, Harland Bartholomew and Frederick Law Olmsted. Mr. Disney's award was for the conservation message in his True Life Adventure series, many parts of which were filmed in national parks. Mr. Rockefeller's award is in recognition of his untiring efforts for the national parks, and most recently his offer to donate more than half of the island of St. John in the Virgin Islands as a national park. Dr. Finley was applauded for his interest, leadership and extensive contributions to the preservation of historic sites, buildings and objects. Mr. Bartholomew was honored for his distinguished service as consultant to the National Capital Planning Commission. Mr. Olmsted's half-century of achievements in park conservation and landscape architecture brought him this well-merited recognition.

Bird Films

Announcement is made by International Film Bureau, Inc., of four films in its Living Science Series No. 2, each film in color and running six to seven minutes. The subjects are "Birds that Eat Seeds", "Birds that Eat Fish", "Birds that Eat Flesh", and "Birds that Eat Insects." The films have been planned and presented by Wesley H. Greene in collaboration with Glenn O. Blough, Austin L. Rand, W. Earl Godfrey and T. M. Shortt. The films are generally available without charge from public libraries, State departments of conservation and boards of education, or for a nominal rental from most university extension departments. Details about these and other films are available from International Film Bureau, Inc., 57 East Jackson Boulevard, Chicago 4, Illinois.

Humane Slaughter

"What You Don't Know about Hamburger and Pork Chops" is the title of a recent leaflet published by The National Humane Society, 733 Fifteenth Street, N.W., Washington 5, D.C. It describes the manner in which beef and pork animals are slaughtered in the majority of slaughter houses. The Society is endeavoring to set up local committees to seek the humane slaughter of meat animals, and to increase the number of packers using acceptable humane measures.

Animals' World Day

Word comes from E. Clifford Pratt of Toronto, Canada, that World Day for Animals this year will be observed October 4, 1956. This observance is also called St. Francis Day. Headquarters of the organization fostering this day is 42 Aberdeen Road, London, N.5, England, from which source information may be obtained.

Elk Herd Reduced

Faced with a range for the northern herd of elk in the Yellowstone only equal to supporting about 5000 animals and with a population of some 12,000 elk, the National Park Service has been struggling with the problem of bringing the elk within bounds of available food. This year weather conditions were such that a reduction of the herd was finally successful. Licensed hunters outside the park accounted for nearly 4000 animals, while park rangers in the high country within the Park took about 2500 elk, and 650 animals were trapped for transfer to restock ranges in Montana and New Mexico. Elk taken by direct control were furnished to various Indian agencies and hospitals and the Bureau of Prisons. A careful air census of the herd is being taken to determine the exact relationship between remaining elk and range capacity.

General Biology

By Harrington Wells and Patrick H. Wells. New York. 1956. McGraw-Hill Book Company. 520 pages. Illustrated. $6.50.

The authors of this biology text are father and son, Professor Harrington Wells being a professor at the University of California, Santa Barbara College, and son, Patrick, Assistant Professor at the University of Missouri. In their preface they state: "This book has been designed as an integrative text and reference for lower-division college and university students. With regard to selective content, the authors' objectives are descriptive as well as explanatory, a basic aim being to further individual orientation in terms of life science. A background knowledge of form and function is held to be essential to a genuine comprehension of principles. Understanding of interrelationships as well as of mechanisms of individual and collective management provides the core of a broad general education, for all life society is fundamentally biological."

Pipefish

(*Continued from page 244*)

and forward, twisting his body spirally from above downward. This activity is performed until all the eggs settle to the bottom of the pouch and then the father is ready to receive more. As many as 570 eggs have been found within the pouch of a single male.

In the pouch the eggs become embedded in its lining. Here they receive nourishment from the pouch lining. Incubation takes about ten days, Dr. Gudger reports, and the baby pipefish are held in the brood pouch of the father until the yolk sac has been absorbed and they are about eight or nine millimeters long. Then the young are ready to go out into the water world. According to Mrs. C. J. Fish, who studied pipefish at Woods Hole, Massachusetts, once the small young pipefish leave their father's pouch they never return to it.

Baby piepfish that have been kept in aquariums have been observed to grow about two inches in the first two months after hatching. At the end of their first year they are believed to be mature.

Because they are bony, hard, and almost fleshless, pipefishes are seldom preyed upon by other fish. The only enemy of the pipefish of which I can find mention is the Portuguese-man-of-war. On numerous occasions the pipefish has been observed hopelessly entwined in the many tentacles of this jellyfish.

The rigidity of the bony plated skeleton of the pipefishes makes these fishes easy to preserve as curios. You simply let them dry out in the sun. On top of my desk as I write this is the dried-out specimen of the pipefish I captured last summer.

Eight different species of pipefish are found in the offshore waters of our Pacific coast, and twelve species on our Gulf and Atlantic coasts, from Texas to Maine.

Fishes closely related to the pipefish include the seahorse, trumpet fish, cornet fish, and snipe fish.

Smokey

(*continued from page 265*)

must be some connection between good manners and gentlemanliness and the love of Nature and interest in wildlife.

Black bear cubs weigh about twelve to sixteen ounces when they are born. There are usually two born to a mother, although the number may range from one to four. They attain a weight of about sixty pounds by the end of their first year, and reach 200 to 250 pounds in about three years, when they are then considered full grown.

Cubs normally spend the first two months of their lives in the den with their hibernating mother. They then usually remain with her for the first two years.

Smokey, Jr., had a different destiny. First it was to become a celebrity, but after that she kept right on growing. Since a bear raised in captivity is most likely to become a bum and a nuisance if turned out in the forest, Smokey, Jr., was sent to a zoological collection near Red Lodge, Montana. There she still basks in the limelight.

Sunspots

(*continued from page 269*)

sand miles in diameter. (The diameter of the sun is 864,000 miles.) The actual size of single spots varies from that of a tiny speck on the sun's disk to an area as much as 30,000 miles wide. Large groups have been known to extend across 125,000 miles or more.

A vast program of world-wide solar observations is being planned in conjunction with the forthcoming International Geophysical Year, from July, 1957, to December, 1958. This will presumably correspond to the next period of maximum solar activity, and it is hoped that the observational results will add much to our knowledge of solar-terrestrial relationships.

In the month of May the New Moon will occur on May 10 and the moon will be full on May 24. A partial eclipse of the moon, not visible in this country, will take place on May 24.

Mercury will be seen in the west shortly after dark during most of the month. It will reach its greatest eastern elongation on May 2, when it will set one hour and 45 minutes after the sun. It will enter the morning sky on May 24. On May 11 it will be found two degrees north of the moon's thin crescent.

Venus, in Gemini, will reach its greatest brilliancy on May 16. Its magnitude at that time will be -4.2. It will be visible in the west after dark and will set at about 10:30 P.M. on May 15. It will move closer to the sun as the month progresses and will accordingly become somewhat less favorable for observation.

Mars, in Capricornus, will rise shortly before 1 A.M. on May 15, and will still be found low over the southern horizon at dawn.

Jupiter, in Leo, will appear overhead right after dark, a short distance to the west of Regulus. It will set at about 1 A.M. on May 15.

Saturn, in Libra and northwest of Antares, will rise at sunset by May 15 and will be visible all night.

Conservation Caravan

August 25 to September 1 are the dates for the trip of the eighth annual adventure on wheels provided by the Conservation Caravan sponsored by the Conservation Forum of New York State and the Buffalo Museum of Science. The trip will provide opportunity to study soil, water, forests and wildlife, with the aid of specialists, in western New York and Pennsylvania and eastern Ohio. Full details may be obtained from Miss Mabel H. James, Buffalo Museum of Science, Buffalo 11, New York.

Feeder and Bath

A combined bird bath and bird feeder has been devised by Dali Products Company, 1710 Cedar Avenue, Cincinnati 24, Ohio. The bath part is above and larger than the feeder and keeps the food dry, and the bath can be inverted in winter to provide more protection to the feeder. Both are mounted on a jointed aluminum stand that should discourage squirrels. The price is $9.95.

One-Fingerlets

This is the title that Bernard A. Hein of 841 Fourth Street, Oshkosh, Wisconsin, chose for his little 62-page collection of verses. The name derives from the fact that he originally pecked the verses out with one finger on a typewriter, making several carbons and sending them to his children and friends. Others read the lines, which the author says he wrote not to prove literary ability but to convey ideas, and urged that the verses be put between covers. So he had them printed and still has some left at one dollar each.

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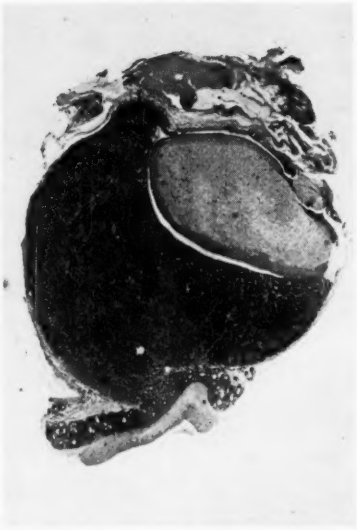
Nature AND THE MICROSCOPE

By JULIAN D. CORRINGTON



Hypophysis, 30X. Dark portion is pars distalis, light area pars nervosa.

The Bodymaster

DEVOTEES OF SHERLOCK HOLMES will experience a cold tingling the entire extent of the spinal canal at mention of the ominous title of our present discourse. They cannot but recall the terrible Bodymaster of Vermissa Lodge 341—the odious Councillor Black Jack McGinty, head of the abominable Scowrers. They might answer, as did Birdy Edwards, alias John McMurdo, alias Jack Douglas, when questioned as to whose body McGinty was master of, "Never of mine, thank God!"

But none the less each such respondent, and each one of the rest of us, has a very powerful and compelling bodymaster, and it is well for us that we do. This commanding structure is a small organ, only the size of a cherry in adult man, but its authority is out of all proportion to its bulk. Allow us, then, to introduce you to your bodymaster, the *hypophysis*, or *pituitary body* or *gland*. From any point of view this structure is one of the most fascinating to study, whether approached from the basis of anatomy, histology, physiology, development, or evolution. Suppose we take it up from each of these means of access in order to comprehend at least its main features.

Like the adrenal (this Department, Oct., 1955), the hypophysis arises in the embryo from two very different sources, although in this case both are ectodermal. The roof of the mouth and adjacent floor of the brain are involved in this joint production, the mouth contributing the *anterior lobe* of the future gland, the brain the *posterior lobe*. In 1838, M. H. Rathke at Konigsberg, the embryologist who discovered gill slits and aortic arches in the embryos of birds and mammals, described the structure that bears his name today—*Rathke's pouch*, a conspicuous and important landmark in the early embryo. This is an outpocketing from the roof of the mouth, growing up toward the brain as a tube with an expanded end, somewhat in the shape of a mushroom button. Meanwhile a corresponding downgrowth starts from the brain. In this region the second of five divisions of the early brain is the one involved, and it is hence called the *diencephalon* (two in-the-head). On its floor there is an eminence of gray matter, the *tuber cinereum* (ashy hump), lying in the midline between the optic tracts. The bottom of the tuber is continued ventrally as the *infundibulum* (funnel), named from its shape, and the expanded end of this funnel makes the posterior lobe. *Hypophysis* indicates a "growth on the bottom," referring to the brain, whereas *pituitary* is from the Latin for phlegm, perpetuating the old notion that this organ produced the nasal secretions.

Rathke's pouch

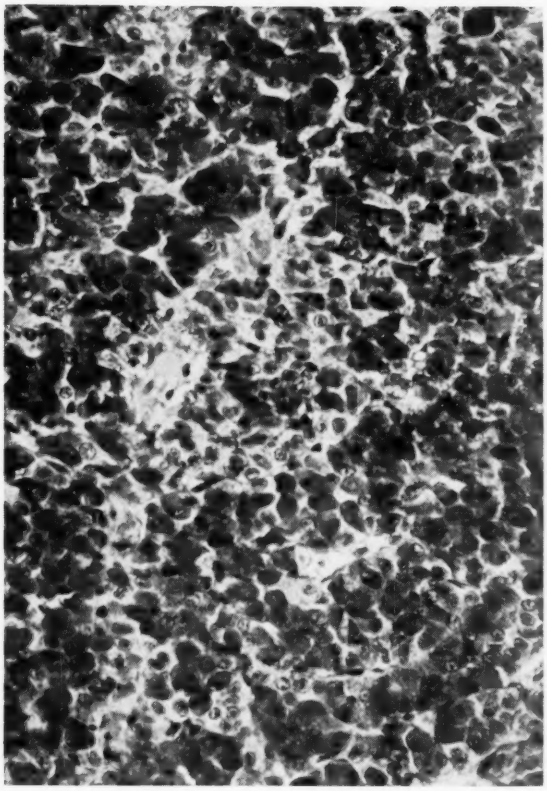
Rathke's pouch loses its connection with the mouth, but the stalk from the brain persists. Cells on the anterior wall of Rathke's pouch multiply and bulge outward to make a rounded mass, the *pars distalis*, while the posterior wall remains thin and constitutes the *pars intermedia*. The pars distalis sends extensions up along each side of the infundibulum, continuing for a short distance over the tuber, more or less enfolding the stalk from the brain, and this portion of the entire gland is termed the *pars tuberalis*. Finally, the mass of nervous tissue at the end of the infundibulum is the *pars nervosa*. The famous anatomist, Cushing, likened the whole to a baseball resting in a catcher's mitt, the posterior lobe (pars nervosa) being the ball. *Pars* is Latin for part, and the pituitary thus has four parts, quite unequal in both size and importance.

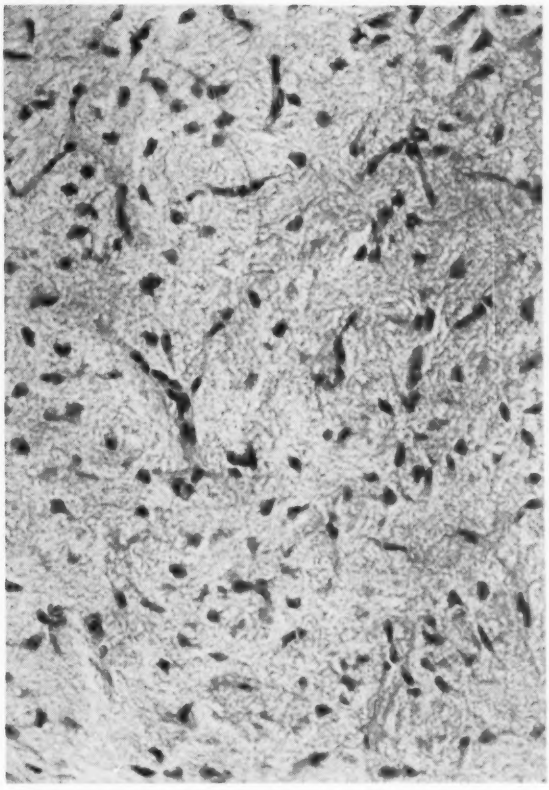
The adult organ is reddish-gray and lies in a pit of the sphenoid bone, on the floor of the brain case of the skull, in the midline. This pit received an interesting name in early descriptive anatomy, the *sella turcica*, or Turk's saddle, from its shape. Both the pia and dura mater, membranes of the brain, surround the gland, affording first class protection and blood supply, the latter of especial importance physiologically, since the pituitary is the master member of the *endocrine system* of ductless glands, and pours its secretions directly into the bloodstream. The location is almost in the exact center of the head—about as secure from harm as any portion of the body.

Examination of microscope slide preparations of the pituitary will reveal the various kinds of cells and tissues that occur in this complex organ. About three-fourths of the whole gland is made up by the pars distalis and it is from this division that most of the secretions are known to come. Somewhere near half of the cells of this part are *chromophobe* (color-hating) cells, that have a non-granular cytoplasm and stain faintly; they are considered to be inactive reserve cells. One third of the cells are *acidophils* (acid-lovers), also called *eosinophils* and *alpha cells*, and one-sixth are *basophils* (base-lovers) or *beta cells;* together they constitute the *chromophil cells*, or color-lovers, that stain readily and have prominent granules in their cytoplasm. All three types of cells are disposed in irregular cords which border on blood sinusoids—thin-walled, wide spaces, into which the products of the pituitary are sent for circulation around the body.

Mystery of the gland

One of the mysteries connected with this master endocrine gland is that not less than six distinct hor-





PHOTOMICROGRAPHS FROM SLIDES LOANED BY WARD'S NATURAL SCIENCE ESTABLISHMENT, INC.

Pars distalis, 450X. Dark cells are chromophils, light ones chromophobes.

Pars nervosa, 450X; pituicytes and nerve fibers.

mones are known to be manufactured by the two kinds of chromophilic cells of the pars distalis, and it is thought that there must therefore be six sorts of cells instead of two. Some histologists make out slight differences among some of these cells. On the other hand, the differences may be entirely chemical in nature, without corresponding visible distinctions; or recognition may await further research.

Hormones known or thought to be produced by the alpha cells include *somatotrophin*, or, following the recent system of using initial letters, *STH*, abbreviation for somatotrophic hormone. Too much of this substance in young and growing individuals leads to giantism, too little to dwarfism, and it is surely amazing that in the vast majority of the population the proper functioning of the alpha cells yields an amount of *STH* that promotes normal growth, conforming to racial and hereditary patterns. After growth has ceased, a pituitary tumor may cause an overproduction of this substance, bringing on the serious condition termed *acromegaly*, in which the bones of the face and extremities continue to grow and thicken and the skin coarsens.

Another alpha cell product is *prolactin*, also termed the luteotrophic hormone or *LTH*, that stimulates the mammary glands to secrete milk. But the most widely publicized product in recent years is *adrenocorticotrophin*, or *ACTH*, which prods the adrenal cortex, and which has been found of value in clinical medicine in a wide variety of diseases, now actively under investigation.

The beta cells are generally designated as the authors of *thyrotrophin* or *TSH*, *follicle-stimulating hormone*, *FSH*, and *luteinizing hormone*, *LH*, the latter two having to do with cyclic changes in the ovary. Other endocrine organs, as the parathyroids and pancreas, are thought to be regulated by productions from the pars distalis of the hypophysis, but specific hormones have not as yet been isolated.

The original cavity of the anterior lobe, representing an extension of the mouth cavity of the embryo, persists as a narrow cleft, or series of isolated clefts in the adult between the pars distalis and pars intermedia, giving the effect that the intermedia seems to be a portion of the pars nervosa (posterior lobe) instead of a slim and compressed division of the

anterior lobe. These clefts contain colloid, but with scarcely any iodine, as do the follicles of the thyroid. The cells are beta cells, but the only known hormone that can be traced to the pars intermedia is one that causes expansion of melanophores or pigment cells and thus a darkening of the skin color in forms below mammals, as frogs. What effect this hormone, *intermedin*, may have in mammals is unknown.

Source of hormones

The pars tuberalis is composed of non-granular cells and is not known to have any endocrine function. The pars nervosa or posterior lobe produces at least three hormones that have important general functions on the economy of the body. The *antidiuretic principle* controls the way in which water is resorbed in the kidney tubules, thus regulating the excretion of urine; *pitocin* initiates contraction of the smooth muscles of the wall of the uterus; *pitressin* works on similar muscles in the smaller blood vessels, thus having to do with blood pressure. The cells that presumably manufacture these secretions are called *pituicytes* and are related to neuroglia cells; there are nerve fibers in the pars nervosa, but no nerve cells. Arterial blood comes to the pituitary from the Circle of Willis and the internal carotids, and there is a portal system, connected with the veins of the infundibulum.

The bodymaster is exclusively a vertebrate organ. In the lowest group, the hagfishes, the infundibulum comes down from the brain and ends blindly. Just below it lies a tube, the *hypophysial duct*, running from the exterior, above the mouth, back into the pharynx. Between the infundibulum and this duct is a mass of cells, the intermediate lobe (pars intermedia), proliferated from the wall of the duct, and constituting the only portion of this apparatus that is glandular. In the lamprey the organ is similar but the hypophysial duct now ends blindly at its inner terminus, not connecting with the pharynx, and the intermediate lobe is much larger. In all vertebrates above lampreys the connection of the hypophysial duct with the exterior is lost, the tube being blind at both ends after the opening of Rathke's pouch with the mouth cavity is obliterated, and making up the anterior lobe or *adenohypophysis*, while the infundibulum thickens at its distal end to comprise the posterior lobe or *neurohypophysis*. The intermediate lobe diminishes in size, and presumptively in importance.

The old Greek idea that this structure was the source of phlegm, whence the name pituitary, sounds ridiculous, but emerges in the light of modern knowledge of the evolution of this master gland as not so wide of the mark after all. It is possible that the hypophysial duct was once the vertebrate mouth, losing its connections and degenerating to a small glandular mass when the present mouth route was established.

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